US Army Corps
of Engineers
Kansas City District

Planning & Engineering Division
Planning & Hydrologic Engineering Branch
Water Control Section

Annual Report of Reservoir Regulation Activities

Summary for 1997-1998

December 1998

MISSOURI RIVER DIVISION, KANSAS CITY DISTRICT
SUMMARY OF LAKE REGULATION ACTIVITIES
AUGUST 1, 1997 TO JULY 31, 1998

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PURPOSE AND SCOPE.

This report summarizes the past year's regulation activities at storage projects operated for flood control under the direction of the Corps of Engineers and within the boundaries of the Kansas City District, and it outlines briefly the programs proposed for the year ahead. Topics discussed in the report include climatology and water supply; project accomplishments; project operations; major regulation problems and proposed solutions; lake regulation manuals; data collection programs and procedures; research programs, studies, and tests; and technical activities and personnel of the Water Control Section, Kansas City District, Corps of Engineers. The period covered by the report extends from August 1, 1997 through July 31, 1998 for the past year's operation, and projected programs through calendar year 1999. Preparation of the report is in conformance with paragraph 13b of ER 1110-2-240, dated October 8, 1982.

LAKES IN THE KANSAS CITY DISTRICT.

The Kansas City District of the Corps of Engineers includes the watershed of the Missouri River from Rulo, Nebraska, (mile 498.0 above the mouth) to the junction of the Missouri and Mississippi Rivers near St. Louis, Missouri. During the period covered by this report 29 storage projects, at which the Corps has either complete or partial water control responsibility, were in operation within the District. The location of each lake and reservoir in the District is shown on Plate 1, and a summary of engineering data outlining the physical characteristics of each facility is included as Plates 2A through 2E.

PROJECT FUNCTIONS AND GENERAL PLAN.

Functions served by storage facilities in the Kansas City District include: flood control, irrigation, water supply, low-flow and navigation supplementation, water quality control, hydropower, recreation, and fish and wildlife. With the exception of flood control and a portion of the fish and wildlife program, the functions listed above are normally provided through the regulation of storage contained in the multipurpose pool. Releases from multipurpose storage are controlled by the manipulation of gates or other means in accordance with plans, schedules, and ratings prepared in advance to meet various conditions of inflow and demand. The general plan for regulation of flood-control storage is to evacuate all accumulations in flood-control space as rapidly as downstream channel capacities and flow conditions permit. Should the top of flood pool be exceeded, criteria have been developed for each project which schedule releases with an aim toward safeguarding the structure. Downstream interests are warned of the possibility of flooding should a surcharge operation appear likely. During this report period, minor deviations from the general plan were permitted at some lakes as water was deliberately accumulated in the flood-control pools for fish and wildlife enhancement. Additional details about the use and regulation of this "dual-purpose" storage are presented in other sections of this report.

CLIMATOLOGY.

At the beginning of the reporting period, precipitation was below normal and temperatures were approximately normal. These conditions continued in the basin until December when precipitation and temperatures both trended to normal levels. Through the

winter precipitation remained approximately normal with above normal temperatures. March and April, for the majority of the basin had above normal precipitation. May and June were below normal to normal precipitation for the majority of the basin, with the exception of southern Iowa, around Rathbun lake, which had above normal precipitation, especially in May. July tended toward normal precipitation with the exception of some fairly heavy storms occurring around the eastern portion of Kansas and Western Missouri. Temperatures during this time were normal.

PROJECT ACCOMPLISHMENTS, 1997-98.

As noted in the previous section, purposes at storage projects in the Kansas City District include flood control, irrigation, water supply, low flow and navigation supplementation, water quality control, hydropower, recreation, fish and wildlife. Project accomplishments in each of these functional areas, for the period covered by this report, are described briefly in the following subparagraphs.

Flood Control.

Stream flow regulation by storage projects in the Kansas City District began with the closure of Kanopolis Lake in February 1948. The first accumulation of flood inflows in a Kansas City District storage project for the purpose of benefiting downstream damage centers occurred also at Kanopolis Lake in July 1948. Since this initial impoundment, stream flow regulation by Kansas City District's lake projects has produced flood prevention benefits estimated in the millions of dollars annually. In addition to the Corps of Engineers lake projects, local protection projects in the form of levees, flood walls, and channel improvements also have provided flood prevention benefits amounting to millions of dollars. Federal and private agricultural levees along with temporary storage of flood flows in the main stem reservoir system above Sioux City, provide additional benefits within the District. Flood prevention benefits during fiscal year 1998 (October 1, 1997 through September 30, 1998) credited to the Corps of Engineers lake projects in the District were $15,382,000.

Table 1: Flood Prevention Benefits October 1, 1997 - September 30, 1998

Project	Fiscal Year	Cumulative
Clinton Lake, KS	$78,000	$738,246,000
Harlan County Lake, KS	$158,000	$138,940,000
Hillsdale Lake, KS	$237,000	$26,217,000
Kanopolis Lake, KS	$422,000	$1,131,002,000
Little Blue River Lakes, MO	$0	$50,813,000
Long Branch Lake, MO	$148,000	$43,485,000
Melvern Lake, KS	$1,216,000	$131,370,000
Milford Lake, Ks	$413,000	$797,841,000
Perry Lake, KS	$438,000	$2,911,342,000
Pomme De Terre Lake, MO	$212,000	$65,164,000
Pomona Lake, KS	$1,072,000	$138,775,000
Rathbun Lake, IA	$2,669,000	$141,332,000
Smithville Lake, MO	$182,000	$384,403,000
Stockton Lake, MO	$222,000	$199,189,000
Harry S Truman Res., MO	$2,098,000	$1,828,656,000
Tuttle Creek Lake, KS	$5,705,000	$3,020,293,000
Wilson Lake, KS	$112,000	$1,100,620,000
TOTAL	$15,382,000	$12,847,688,000

Irrigation.

Carryover storage at Bureau of Reclamation lake projects was generally near or above normal at the end of the 1997 irrigation season, with the exception of Harry Strunk Lake and Lovewell Reservoir. The 1997 carryover storage at Keith Sebelius Lake (Norton Dam) was the second highest of record. The 1998 irrigation season ended with above normal

system carryover storage, although total storage at Republican River basin projects was lower than at the end of the 1997 season.

The eleven Reclamation reservoirs in the Kansas River basin, plus the Corps' Harlan County Lake, provided 287,646 acre-feet of irrigation water to 152,600 acres of project lands during calendar year 1997, the latest period for which final values are available.

The State of Colorado makes Bonny Reservoir storage water available to Hale Ditch and other natural flow appropriators under short-term water service contracts. Most of the 700 acres served by Hale Ditch are now owned and operated by the Division of Wildlife, Colorado Department of Natural Resources. During 1997, at the request of the State of Colorado, 2,055 acre-feet of water were diverted to Hale Ditch, and 2,398 acre-feet were diverted in 1998.

Municipal, Industrial, and Quality Control.

Three municipalities and one rural water district have executed water service contracts for full or supplemental water supplies from three Bureau of Reclamation reservoirs. A contract with the city of Norton, Kansas, provides for a maximum annual usage of 1,600 acre-feet from Keith Sebelius Lake (Norton Dam). A contract with Beloit, Kansas, provides for a maximum annual usage of 2,000 acre-feet from Waconda Lake. Waconda Lake also provides up to 1,009 acre-feet of water for a contract with the Mitchell County Rural Water District No. 2. A contract with the city of Russell, Kansas, provides for a maximum annual usage of 2,000 acre-feet from Cedar Bluff Reservoir.

During calendar year 1997, the City of Norton used 454 acre-feet of storage from Keith Sebelius Lake for municipal purposes. No storage releases were made from Waconda Lake for the city of Beloit; however, 3,472 acre-feet was bypassed for water quality control as directed by the Kansas State Water Commissioner. Releases of 696 acre-feet were made to the Mitchell County Rural Water District No. 2 from Waconda Lake. No releases were made from Cedar Bluff Reservoir for the City of Russell. The State of Kansas used the fish hatchery below Cedar Bluff Dam for nurturing Canadian Geese. Approximately 22 acre-feet of water were released from Cedar Bluff Dam in 1997 for use at the fish hatchery.

The Corps of Engineers Water supply contracts the State of Kansas and 13 cities and/or rural water districts within the four-state area of Kansas, Missouri, Iowa, and Nebraska. Municipal water is supplied within the limits of each contract to these entities through designated releases (or directly from the pool itself) from the following lakes: Tuttle Creek, Kanopolis, Rathbun, Long Branch, Smithville, Harry S. Truman, Stockton, Hillsdale, Melvern, Pomona, Clinton, Perry, and Milford.

Minimum flow requirements for stream sanitation and for the maintenance of desirable chemical quality standards have been established for numerous river reaches in the Kansas City district. In general, these objectives conform to the recommended drinking water standards of the U.S. Public Health Service. In accordance with Health Service recommendations, releases for quality control and/or low-flow supplementation were made during the report period from Corps' projects in the Kansas City District. Minimum releases for the purpose of quality control and stream sanitation for downstream channels range from 3 cubic feet per second (c.f.s.) during the winter months at Hillsdale Lake to 100 c.f.s. the year

round at Tuttle Creek Lake. Flows were reduced below minimum requirements for brief periods due to construction or emergency operations at some projects. Seepage is generally considered sufficient to meet minimum flow requirements downstream at most of the Reclamation's dams. In addition, releases are made from Tuttle Creek, Milford, and Perry Lakes for water quality purposes during periods of low flow on the Kansas River.

Navigation.

Releases from the Missouri River main stem reservoir system are designed to provide equitable service to power and navigation, while at the same time recognizing the important flood control functions of the system. In years of excess water supply, releases greater than full service navigation requirements are made from the main stem to evacuate flood control space. In normal times, power releases from the Missouri River Division's Gavins Point Dam, plus normal pickup in the Missouri River between Gavins Point and Kansas City, keep navigation flows at full service level through the reach from Kansas City to the mouth. Releases for navigation supplementation from Kansas River basin lakes are not required in either of the above-mentioned situations. However, during years of below normal water supply, Kansas basin lakes are at times called upon to supplement Missouri River flows below Kansas City in order to meet the navigation requirement without spilling water past the power plant at Gavins Point Dam, or to conserve water in the main stem lakes. Navigation on the Missouri is limited to the ice-free season with a full season normally extending from April 1 to December 1 at the mouth. When an abundance of water is available, the season is often extended an additional 10 days at the end of the season, ice conditions permitting. This situation existed in the fall of 1997, and the navigation season was extended accordingly. Operating experience plus numerous studies have indicated that flows of 35,000 c.f.s. at Kansas City are the minimum that will permit navigation. In consideration of groundings which may still occur with flows of that magnitude and the dredging which would be required to maintain satisfactory navigation, an additional flow of 6,000 c.f.s. above the minimum has been set as "full service" level for navigation function. Thus, a flow of 41,000 c.f.s. at Kansas City is considered adequate to maintain the designed 9-foot by 300-foot channel with little or no dredging. No releases for navigation were scheduled from Perry, Tuttle Creek, and Milford Lakes during this report period.

Hydropower.

Normal operation of the Stockton hydroelectric facility consists of peaking power generation at a rate of 40 to 45 megawatts for a period of 2 to 10 hours daily throughout the workweek. Releases scheduled for the Harry S. Truman hydroelectric plant anticipate peaking power generation primarily during the months of June through September, with additional generation at other times of the year as water is available and there is a need.

Stockton's power operation continues to be restricted by downstream channel capacities that limit tailwater elevations to 777.0 feet, mean sea level (ft., m.s.l.) and Highway "J" stages to a maximum reading of 17.5 feet. Generation by the Stockton plant during this report period totaled 45,916 megawatt hours.

Generation by the Harry S. Truman plant totaled 284,928 megawatt hours during the period of this report. Power generation releases at Harry S. Truman are currently restricted to

four units during the week and three units on weekends between Memorial Day and Labor Day. During the period December 1 to March 1, five units may be operated during the weekdays (total time limited to 600 hours per year) and three units on weekends. The tailwater elevation measured at the Highway 7 bridge at Warsaw is limited to 662.5 feet, Union Electric datum, during five-unit releases from the power pool. When Truman pool level is above 710.0 feet, a minimum of one unit is operated continuously. This interim operation plan for Truman was negotiated and approved between the Corps, the State, and the Southwestern Power Administration, and became effective March 1990.

At the Harry S. Truman power plant, five units are currently available for power generation. The final unit is scheduled to return to service in September 1999.

Recreation.

Visitation figures compiled for 18 operating Corps' lakes in the Kansas City District indicate an increase in visitation hours at nine projects and also a decrease in visitation hours at nine projects. Total visitation hours for the 18 projects is slightly less then the previous year. Fee collection totals showed an overall increase of $37,564 the previous year. A list by projects of the visitation totals and the fees collected at each of the Corps lakes is shown in Table 2.

Table 2: Visitation and Fee Collection, October 1, 1997 - September 30, 1998

Project	Visitation (Visitor Hours)	Fees Collected
Blue Springs	1,390,001	$0
Clinton	6,593,264	$27,864
Harlan County	7,547,172	$115,163
Harry S. Truman	13,933,352	$494,622
Hillsdale	1,253,357	$738
Kanopolis	2,473,161	$48,385
Long Branch	1,210,135	$188
Longview	2,778,466	$955
Melvern	6,061,902	$178,096
Milford	5,587,609	$103,660
Perry	6,072,809	$203,519
Pomme de Terre	13,708,118	$254,595
Pomona	3,530,790	$91,989
Rathbun	5,198,975	$227,981
Smithville	6,720,695	$788
Stockton	7,740,431	$293,635
Tuttle Creek	2,437,490	$16,050
Wilson	1,764,721	$74,143
Total	96,002,448	$2,132,371

Fish and Wildlife.

Water level management plans, which include the fluctuation of pool levels at various times of the year for the enhancement of fish and migrating waterfowl, were in effect during the report period at Smithville, Clinton, Hillsdale, Kanopolis, Melvern, Wilson, Pomme de Terre, Perry, Pomona, Milford, Tuttle Creek, Waconda, Stockton, Rathbun, and Long Branch Lakes.

PROJECT OPERATIONS.

Actual operations for the year just passed and proposed operations through calendar year 1999 are discussed briefly in the following subsections.

Corps of Engineer Lakes - August 1, 1997 through July 31, 1998.

Corps projects within the Kansas City District were regulated in accordance with normal procedures during the period covered by this report. Details regarding the regulation

of all projects, along with pool elevation hydrographs, are included in Appendix A of this report. Releases shown on the charts are gated releases.

During the past reporting period from August 1997 to July 1998, the District experienced a fairly normal year, with the exception of some fairly heavy rainfall in March and April resulting in higher than average pool elevations at Long Branch, Truman and Rathbun. None of the Corps projects reached a record high pool elevation. At the beginning of the period, most of the Corps projects were operating at or near their multipurpose level. It was evacuating storage from an event earlier in the year. At the end of the report period 15 out of the 18 Corps' lakes had water stored in the flood control pool. The major ones were Rathbun, with 36 percent occupied, Blue Springs with 19 percent occupied, Long Branch with 17 percent and Longview with 15 percent occupied.

Operation of Tuttle Creek Lake during the summer of 1998 was affected by the presence of two bird species listed on the Federal Threatened and Endangered Species List. Thirty-nine least terns and 6 piping plovers were observed nesting on the Kansas River downstream of Tuttle Creek Lake in 1998. Lake operation was adjusted to avoid adversely impacting the nesting of these two Federally-listed species. Eighteen active nests were observed at 9 different locations on the Kansas River. Releases from the lake were maintained at a level to prevent flooding of these nests on the Kansas River.

Bureau of Reclamation Projects - August 1, 1998 through July 31, 1999.

Reservoir operations at the 11 Bureau of Reclamation projects in the Kansas City District were carried out in accordance with normal regulation procedures during the period covered by this report. At the Bureau projects, all operations are scheduled for optimum benefits of the authorized project functions. Monthly, or as often as runoff and weather conditions dictate, the Bureau evaluates the carryover storage and estimated inflow at each reservoir to determine whether excess water is anticipated. If excess inflow is apparent, controlled releases are made to maximize the downstream benefits, including flood control.

The regulation of flood control storage in Bureau of reclamation reservoirs in the Kansas River basin has been assigned to the Kansas City District, Corps of Engineers. When inflows are sufficient to produce an encroachment into the flood pool, coordination is immediate between the two Federal agencies, and decisions are made regarding the regulation desired. Regulation orders are issued by the Corps, received by the Bureau's Water Control Field Branch in McCook, Nebraska, and forwarded to the Reservoir Superintendent at the project. The Water Control Field Branch in McCook is responsible for issuing orders for the conservation releases directly to the Reservoir Superintendent. Details on operation of the Bureau's reservoirs, along with pool elevation hydrographs, are included in Appendix B of this report.

Carryover storage from the 1997 irrigation season was higher than normal, and inflows at most central and eastern Kansas and Nebraska projects continued higher than normal through 1997 – 98 operating year. Inflows at many western Kansas and Nebraska projects were less than normal. Basin-wide system storage at the end of the 1998 irrigation season was above normal.

Proposed Operations - August 1998 Through Calendar Year 1999.

Corps and Bureau of Reclamation storage projects in the Kansas City District contained a total of 5,944,570 acre-feet of storage on August 1, 1998. This total is 525,145 acre-feet more than the volume in storage on this date one year earlier. Of the total volume in storage, 856,175 acre-feet (14 percent) were contained in the Bureau of Reclamation's lakes and 5,088,395 acre-feet (86 percent) were contained in the Corps' projects. The total storage of 832,932 acre-feet in the Bureau of Reclamation lakes is an increase of 23,243 acre-feet in storage compared to this date one year earlier.

Sixteen of the operating lakes in the District contained storage in their flood control pools on August 1, 1998, with the occupied storage amounting to 565,476 acre-feet. This volume compares to 40,035 acre-feet of flood control storage space occupied on August 1, 1997.

MAJOR REGULATION PROBLEMS AND PROPOSED SOLUTIONS.

No deviations occurred during this reporting period.

LAKE REGULATION MANUALS.

This section of the annual report serves to provide the information requested in paragraph 13c of ER 1110-2-240, dated October 8, 1982, regarding status of water control manuals.

Manual Status.

Water control plans prepared for specific projects and basins within the Kansas City District have been documented in appropriate manuals as directed by paragraph 6c of the above referenced ER. Paragraph 6c also directs that water control plans be revised as necessary to conform with changing requirements resulting from developments in the project area and downstream, improvements in technology, new legislation, or other relevant factors, provided such revisions comply with existing Federal regulations and established Corps of Engineers policy.

The water control manual for Pomme de Terre was reviewed by the Northwestern Division Missouri River Region and returned for corrections and clarifications on March 18, 1997. The water control manual for Wilson was submitted to the Missouri River Region for review on June 13, 1997. The schedule and status of manuals for all projects is shown on Table 3.

Table 3: Project Manual Status and Revision Schedule

Reservoir/Lake	Stream/River	Owner	Report Status	Submission Schedule
Nebraska				
Master Manual	Republican	CE	Updated final submitted to MRD for review 28 July 1977	Sep 2002
Harlan County	Republican	CE	Approved 20 August 1973	
Harry Strunk	Medicine Creek	BR	Approved by MRD 12 July 1974	
Enders	Frenchman Creek	BR	Approved by MRD 26 March 1973	
Swanson	Republican	BR	Flood Control Regulation approved by OCE 6 Oct 1969	
Hugh Butler	Red Willow Creek	BR	Flood Control Regulation approved by OCE 21 Nov 1969	
Colorado				
Bonny	S. Fork Republican	BR	Approved OCE 6 Oct 1969	Dec 1999
Kansas				
Lovewell	White Rock Creek	BR	Approved OCE 9 Apr 1969 subject to comments	
Milford	Republican	CE	Approval Dec 1984. Minor revision approved Jan 1995	
Norton	Prairie Dog Creek	BR	Approved 28 Aug 1974	
Master Manual	Smoky Hill	CE	Approved 28 Mar 1975	
Kanopolis	Smoky Hill	CE	Revision submitted 30 Oct 1994	
Cedar Bluff	Smoky Hill	BR	Approved by MRD 25 Sep 1975	
Kirwin	N. Fork Solomon	BR	Approved by MRD 6 Feb 1974	
Webster	S. Fork Solomon	BR	Approved by MRD 16 Jul 1975	
Wilson	Saline	CE	Submitted to MRD 13 Jun 1997	
Waconda	Solomon River	BR	Approved by MRD 12 Jul 1972	
Master Manual	Kansas	CE	Approved by OCE 22 Mar 1967 subject to comments	Sep 2003
Tuttle Creek	Big Blue	CE	Approved 16 Apr 1974. Minor revision approved Jan 1995.	
Perry	Delaware	CE	Approved Jul 1973. Minor revision approved Jan 1995.	Dec 2000
Clinton	Wakarusa	CE	Approved 12 Feb 1980	
Master Manual	Osage River	CE	Approved by OCE 21 Sep 1970 subject to MRD & OCE comments	
Pomona	110 Mile Creek	CE	Approved Feb 1973	Dec 2000
Melvern	Marais Des Cygnes	CE	Approved 27 Jun 1985	
Hillsdale	Big Bull Creek	CE	Approved 19 Jun 1985	
Missouri				
Pomme De Terre	Pomme De Terre	CE	Updated manual submitted to MRD Sep 1996.	
Harry S. Truman	Osage	CE	Interim manual approved by MRD 12 May 1981, minor revision approved Apr 1996.	
Stockton	Sac	CE	Approved 21 Aug 1975	
Smithville	Little Platte	CE	Approved 13 Aug 1979	
Long Branch	E. Fork Ltl. Chariton	CE	Interim manual approved 21 Nov 1978	Dec 1999
Longview	Little Blue	CE	Approved 15 Feb 1994	
Blue Springs	E. Fork Little Blue	CE	Approved 27 Jan 1994 subject to comments. Revision submitted to MRD Dec 1994.	
Iowa				
Rathbun	Chariton	CE	Approved 19 Oct 1981	

Other Reports.

Plates 2A-E list project data showing the date impoundment of storage began, the date multipurpose pool (the active conservation pool in USBR projects) first filled, and the current status of Standing Instructions for Regulation of Storage in Corps of Engineers Lakes.

As indicated in Engineering Manual 1110-2-3600, it is essential that project operators (dam tenders, power plant superintendents) at the various flood control and multiple-purpose reservoirs be supplied with regulation schedules to be followed in case of communication failure. These regulation schedules should be followed in case of communication failure with the headquarters from which instructions are normally issued during flood situations.

Standing Instructions have not yet been issued for Truman Reservoir, Clinton, Hillsdale, Long Branch, Smithville, Longview, and Blue Springs Lakes.

HYDROLOGIC DATA COLLECTION - PROGRAM AND PROCEDURE.

The primary objectives of any hydrologic data program is to provide information on precipitation and streamflow characteristics occurring over and within a particular area for a given period of time. These data are used for many purposes, including the design, construction, and maintenance of a wide variety of structures in and along streams; the control and management of floods; the production of hydropower; the design and maintenance of navigation facilities; the control of pollution; the management of flood plains; the development of recreational facilities; the design of highway bridges and culverts; the establishing and administering of water rights and compacts; and the resolving of political, social, and legal water problems. As with any program, however, the restraint on funds and manpower, and the usefulness of the data obtained will determine to what extent the program will, or should, be pursued at any particular point in time. The overall program of observing, monitoring, and collection of hydrologic and meteorological data in the Kansas City District is quite extensive, yet is flexible to meet operational and economic needs. Brief descriptions of the various types of data collection now being utilized are presented in the following paragraphs.

Collection of Water Control Data.

Hydrologic data such as precipitation, stream flow, and lake information are collected in the Kansas City District by the following: observers, project offices, the National Weather Service (NWS), the Geological Survey (USGS), and the Bureau of Reclamation. Several different methods of communication are used in the Kansas City District to collect these data. Telephone and fax communications are used to collect the data that come directly to the Water Control Section from observers and field personnel. Operational and hydrologic data for the Bureau of Reclamation's projects are transferred by e-mail or fax by Reclamation's field office in McCook, Nebraska, to the Water Control Section. Personal computers are used for access to the Corps' Missouri River Automated Data System (MRADS). The MRADS database provides an automated method of processing, recording, and distributing data for all users. Water control data obtained from the various sources are entered into the MRADS database daily. Once entered into the database, information is available to users Division-wide for forecasting, data listings, reports, bulletins, and charts.

Automatic Remote Sensors.

In addition to the procedures and facilities mentioned in the above paragraph, data is also received from gauging sites within the District through the application and installation of automatic remote sensors. NWS Telemarks and LARCS are manually interrogated by standard telephones. Data Collection Platforms (DCP) automatically transfer data through a GOES satellite to the NESS and Omaha downlinks. NESS relays data directly to the District through DOMSAT. The Kansas City District currently has 161 DCPs in use. A breakdown of the total number of DCPs, by states, shows 51 units in Missouri, 93 in Kansas, 13 in Nebraska, and 4 in Iowa.

Cooperative Hydrologic Programs.

As mentioned earlier, a restraint on funds and manpower at times can limit the extent of a data collection program to the point where optimum operations of a project or series of

projects will not be possible. In these occasions, assistance is sought from other cooperating agencies. A nationwide program of data collection at selected stream gauging stations has been administered for a number of years by the USGS. A similar network of reporting stations has been operated by the NWS for their river forecasting services. Quite often, however, neither of these programs has adequate station coverage nor sufficient frequency of reporting to satisfy Corps requirements in certain areas. Accordingly, cooperative arrangements have been made with the Geological Survey and the National Weather Service through which they supplement their network of reporting stations, or increase the frequency of reports, to better satisfy Corps of Engineers' needs. These programs, designated "Cooperative Hydrologic Reporting Networks" are administered by the USGS and the NWS and are supported by funds transferred to the two agencies from the Corps. Arrangements for the services provided are made with local representatives of the two agencies and submitted annually to the Chief of Engineers, through the Division Engineer, for review and approval. A summary of funds expended for data collection purposes during the report period is included in the Personnel and Funding section at the end of this report.

Water Quality Investigations and Monitoring Activities.

The Water Quality Unit's (PE-PR-W) 1998 activities were highlighted by the continuation of the long-term watershed studies of the Big Bull (Hillsdale Lake), the Chariton (Rathbun Lake), and Little Platte (Smithville Lake), and the conclusion of the Water Quality Model Study of The Lower Osage River Basin. The Big Bull watershed cooperative studies with Environmental Protection Agency (EPA) 319 funding involve numerous federal, state, county, and local agencies, as well as citizen groups, in quantifying the levels of nutrients and herbicides throughout the watershed and implementing pollution reduction strategies. The latter included increased use of best management practices on agricultural lands and the use of constructed wetlands to improve the quality of point-source effluents. The PE-PR-W continued to perform the lake-monitoring portion of the work, which included monthly sampling, analyses, coordination with other laboratories, and data management.

In the second year of the multi-agency, cooperative study of the Chariton watershed, the PE-PR-W and Rathbun Lake Project personnel teamed to perform biweekly surveys of three lake stations, the outlet, and the two major inflow stations. The U.S. Geological Survey sampled eleven smaller tributaries, and the PE-PR-W and Chemical and Materials Quality Assurance (CMQAL) laboratories performed the herbicide and nutrient analyses, respectively. As in the Big Bull watershed studies, the Natural Resources Conservation Service (NRCS) with major support from 319 funding assisted in obtaining the voluntary support of the agricultural community in reducing the amount of non-point source runoff.

Support and commitment for the Little Platte watershed management activities continued to grow in 1998. For its part the PE-PR-W performed six monthly surveys of the lake, its outlet, and a major tributary during 1998. Physical, chemical, and biological analyses were performed by the unit and CMQA laboratories. Coordination meetings to define the role of all participants in the basin studies were held, and PE-PR-W presented past and present water quality findings at two public meetings. Field and mobile laboratory equipment and procedures were demonstrated as part of a watershed tour.

Contract work was completed on the Water Quality Model Study of the Lower Osage River Basin during 1998, with the addition of anoxic conditions in the water column and sediment to the existing HEC5Q system model. The final calibration and sensitivity tests were completed in March and the final report was received in August. A feasibility study of the use of this model as a real time model by the Water Control Section will be conducted during 1999. The model in its present form will be used as a water quality monitoring and learning tool.

The following lake projects supported the NWK water quality monitoring effort in 1998: Long Branch, Clinton, Perry, Milford, Tuttle Creek, Wilson, Kanopolis, Melvern, and Harlan County. A total of 100-120 samples per month were collected by lake personnel at lake, outlet, and inflow stations and analyzed by the PE-PR-W and the CMQA laboratories for herbicides and nutrients, respectively. In addition, the PE-PR-W provided equipment, training, and technical support to the cooperating projects.

The water quality unit conducted a special study comparing the water quality conditions in Drake Harbor, the new Warsaw, Missouri, city park cove constructed by the District, with two other similar coves in the upper reaches of Lake of the Ozarks. The unit prepared a report of findings at the request of city administrators.

Routine water quality surveys of Blue Springs and Longview lakes were conducted by PE-PR-W in 1998. Special investigations of low dissolved oxygen conditions were also conducted at Truman and Pomme de Terre lakes. Subsequently, the data obtained from all sources were entered by PE-PR-W in the EPA Storet water quality database. Using these data, annual reports were prepared for each NWK lake surveyed. Data retrievals were also provided to numerous agencies, A-E firms, universities, and individuals upon request.

Other activities required to support the sampling and analytical capabilities of PE-PR-W were the procurement of supplies and equipment, maintenance and calibration of field and laboratory equipment, and maintenance of the mobile laboratory and marine equipment. The PE-PR-W unit also carried out a quality assurance/quality control (QA/QC) program with CMQA Laboratory and the Johnson County Waste Water Laboratory, the primary laboratory in the Big Bull watershed studies. To further the capabilities, PE-PR-W personnel completed training in Word97, HEC-DSS, and safe driving.

Sediment Observations.

During the FY 1998 reporting period, cross sections were surveyed at stream channel degradation ranges downstream of Clinton, Blue Springs, Kanopolis, Long Branch and Stockton Lakes. No hydrographic surveys were done at Corps Projects during this reporting period. Bed material samples were collected on the Missouri River from Ponca, Nebraska to St. Louis, Missouri in August 1997.

A scope of work was completed for sediment availability analysis for the authorized construction of the Missouri River Levee Unit L385.

RESEARCH AND STUDIES.

Water Control Section staff are included on a District team for the Upper Mississippi River Flow Frequency Study, a cooperative study with four other Disticts, other Federal agencies, and public and academic interests. During this reporting period, Kansas City District

developed a scope of work for their portion of the study. Contracts have been issued for a mapping effort along the main stem of the Missouri River, for development of a UNET model of the 1920's development of the river and an analysis of the effects of Kansas and Osage basin development on the Missouri River flow series. The district also tasked the Bureau of Reclamation to analyze basin development and determine depletions for the period of interest. Hydrological studies should be completed by the end of FY 1999.

Water Control Section staff are also part of a District team providing information and analysis for Republican River Basin studies being conducted by the Bureau of Reclamation. The Corps is a cooperating agency for these studies, and the work will contribute to a separate District operational study of Harlan County Lake.

A study is being done on the Sedan Bottoms which is a 4 mile stretch of river below Rathbun Lake Dam which has several large uncontrolled drainage areas. Sustained bankfull releases from the dam were not allowing adequate field drainage in this area. In 1980, a revised Rathbun Lake Regulation Manual was adopted to address this issue. The USDA Natural Resources Conservation Service (NRCS) through the Wetlands Reserve Program (WRP) has converted a significant amount of agricultural acreage in the Sedan Bottoms to wetlands. This ongoing study will assess this landuse change and any potential changes to the water control regulation plan at Rathbun Lake.

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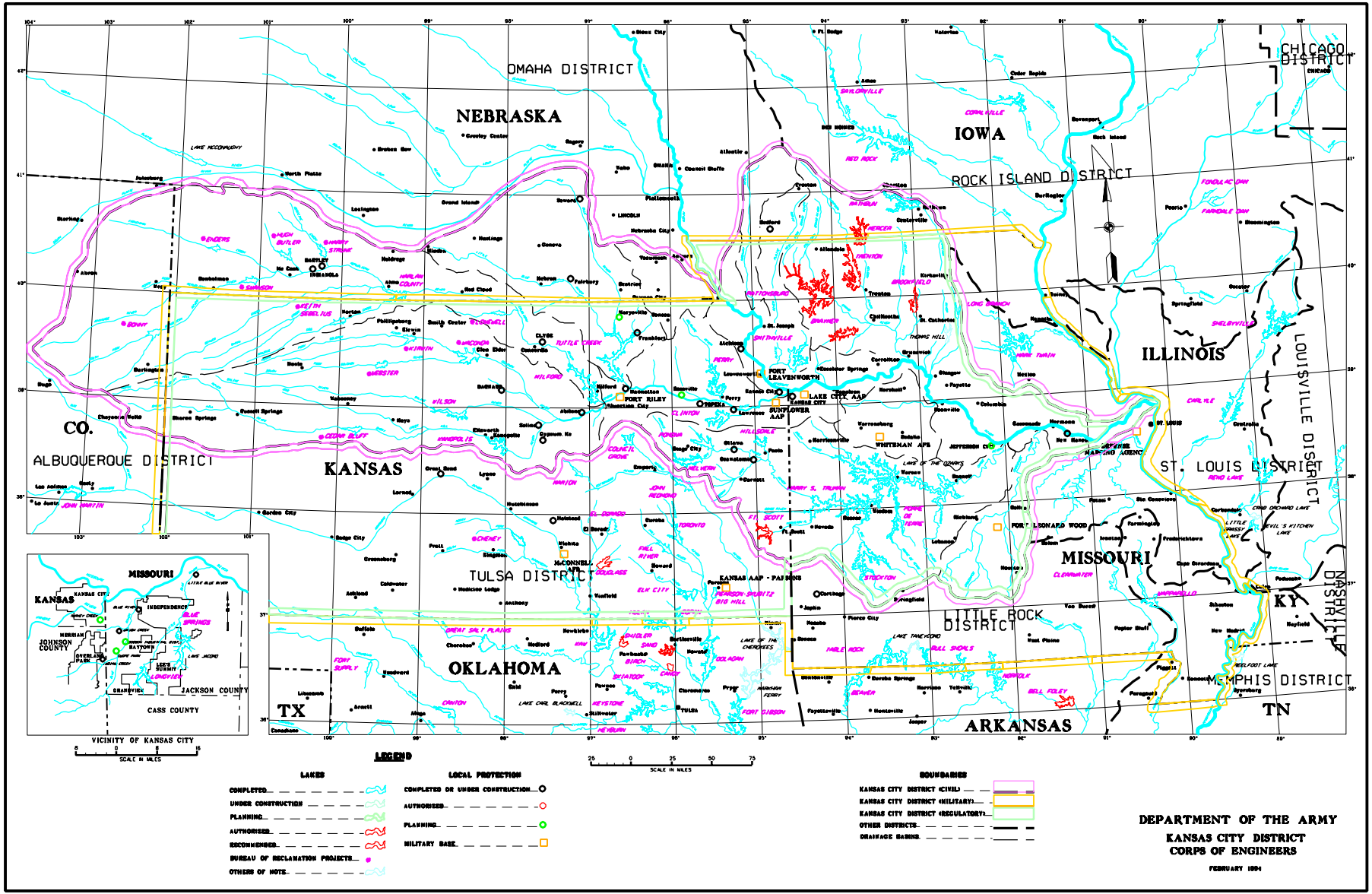
OMAHA DISTRICT
CHICAGO DISTRICT
NEBRASKA
IOWA
ROCK ISLAND DISTRICT
ILLINOIS
LOUISVILLE DISTRICT
CO.
ALBUQUERQUE DISTRICT
KANSAS
ST. LOUIS DISTRICT
MISSOURI
TULSA DISTRICT
KY
LITTLE ROCK DISTRICT
NASHVILLE DISTRICT
OKLAHOMA
MEMPHIS DISTRICT
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ARKANSAS
VICINITY OF KANSAS CITY
SCALE IN MILES
LEGEND
LAKES
COMPLETED
UNDER CONSTRUCTION
PLANNING
AUTHORIZED
RECOMMENDED
BUREAU OF RECLAMATION PROJECTS
OTHERS OF NOTE
LOCAL PROTECTION
COMPLETED OR UNDER CONSTRUCTION
AUTHORIZED
PLANNING
MILITARY BASE
BOUNDARIES
KANSAS CITY DISTRICT (CIVIL)
KANSAS CITY DISTRICT (MILITARY)
KANSAS CITY DISTRICT (REGULATORY)
OTHER DISTRICTS
DRAINAGE BASINS
DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT
CORPS OF ENGINEERS
FEBRUARY 1994

SUBJECT	MELVERN LAKE	POMONA LAKE	HILLSDALE LAKE	STOCKTON LAKE	POMME DE TERRE LAKE	HARRY S. TRUMAN RESERVOIR
GENERAL						
Location of Dam	Near Melvern, KS	Near Pomona, KS	Near Paola, KS	Near Stockton, MO	Near Hermitage MO	Near Warsaw, MO
Stream / River	Marais des Cygnes River	110 Mile Creek	Big Bull Creek	Sac River	Pomme de Terre River	Osage River
Miles above Mouth	175.4	8.3	18.2	51.4	45.6	175.1
Contrib Drainage Area, Sq Miles	349	322	144	1,160	611	8,914 (4)
Approx Length of Full Reservoir, Miles	22	12	15	24	28	122
Shoreline, Miles (1)	101	52	51	298	113	958
Max Disch of Record near Damsite	68,500 cfs (11 July 1951)	38,600 cfs (11 July 1951)	45,200 cfs (11 July 1951)	120,000 cfs (19 May 1943)	70,000 cfs (8 August 1927)	259,000 cfs (17 May 1943)
Date of Closure	2 October 1970	19 July 1962	15 June 1980	23 September 1968	28 June 1960	21 July 1977
Date Storage Began	1 August 1972	18 October 1963	19 September 1982	12 December 1969	29 October 1961	7 February 1979
Multipurpose Level Reached	4 April 1975	5 June 1965	23 February 1985	18 December 1971	15 June 1963	19 November1979
Operating Agency	Corps of Engineers	Corps of Engineers	Corps of Engineers	Corps of Engineers	Corps of Engineers	Corps of Engineers
DAM AND EMBANKMENT						
Top of Dam Elevation, Feet msl	1,078	1,031	952.2	911	906	756
Length of Dam, Feet (net)	9,650	7,750	8,700 plus 3,300 dike	5,100 plus 5,600 dike	4,630 plus 2,790 dike	5,000 plus 7,500 dike
Damming Height, Feet (2)	105	83	79	132	124	105
Type of Fill	Earth	Earth	Earth	Rock Shell	Earth	Earth
Fill Quantity, cubic yards	9,100,000	5,200,000	6,964,000	7,100,000	5,800,000	8,500,000
SPILLWAY						
Location	Left Abutment	Right Abutment	Right Abutment	Left Abutment	Right Abutment	Center of Dam
Crest Elevation, Feet msl	1,057	1,006	935	861.5	874	692.3
Width, Feet	200	200	50	160	170	160
Number, Size, and Type of Gates	None	None	None	4 - 40'x30.5' Tainter	None	4 - 40'x47.3' Tainter
Disch Capacity, Top of Surcharge Pool	36,000 cfs	50,300 cfs	4,750 cfs	182,500 cfs	73,000 cfs	284,000 cfs
RESERVOIR (3)						
Surcharge Pool Elevation & Area	1,073 ft msl 22,673 ac	1,025.4 ft msl 14,584 ac	948 ft msl 10,983 ac	906.2 ft msl 48,053 ac	900.2 ft msl 25,456 ac	751.1 ft msl 295,870 ac
Flood Control Pool Elevation & Area	1,057 ft msl 13,935 ac	1,003 ft msl 8,522 ac	931 ft msl 7,410 ac	892 ft msl 38,281 ac	874 ft msl 16,000 ac	739.6 ft msl 209,048 ac
Multipurpose Pool Elevation & Area	1,036 ft msl 6,912 ac	974 ft ft msl 3,865 ac	917 ft msl 4,580 ac	867 ft msl 24,632 ac	839 ft msl 7,790 ac	706 ft msl 55,406 ac
Surcharge Storage	(1,073 - 1,057) 289,410 af	(1,025.4 - 1,003) 255,327 af	(948 - 931) 155,799 af	(906.2 - 892) 608,708 af	(900.2 - 874) 535,724 af	(751.1 - 739.6) 2,910,768 af
Flood Control Storage	(1,057 - 1,036) 208,207 af	(1,003 - 974) 176,123 af	(931 - 917) 83,570 af	(892 - 867) 776,068 af	(874 - 839) 406,821 af	(739.6 - 706) 4,006,415 af
Multipurpose Storage	(1,036 - 960) 152,051 af	(974 - 912) 64,208 af	(917 - 852.5) 76,270 af	(867 - 760.4) 874,887 af	(839 - 750) 237,356 af	(706 - 630) 1,180,617 af
Sediment Reserve Storage	26,000 af	28,000 af	11,000 af	25,000 af	13,000 af	244,000 af
Gross Storage	(1,057 - 960) 360,258 af	(1,003 - 912) 240,331 af	(931 - 852.5) 159,840 af	(892 - 760.4) 1,650,943 af	(874 - 750.1) 644,177 af	(739.6 - 630) 5,187,032 af
Estimated Annual Sediment Inflow	260 af 100 years	280 af 100 years	110 af 100 years	250 af 100 years	260 af 50 years	2,440 af 100 years
OUTLET WORKS						
Location	Right Abutment	Right Abutment	Left Abutment		Right Abutment	
River Outlet Type	Gated Horseshoe Conduit	Gated Horseshoe Conduit	Gated Oblong Conduit	None	Gated Tunnel	None
Number and Size of Conduit	1 - 11.5'	1 - 13.5'	1 - 15.92'x11.67'		1 - 14'	
Length of Conduit, Feet	754	720.5	685		560	
Entrance Invert Elevation	962 ft msl	925 ft msl	868 ft msl		750 ft msl	
Disch Cap, Top of Surcharge Pool	6,700 cfs	9,200 cfs	8,200 cfs		12,750 cfs	
Disch Cap, Top of Flood Control Pool	6,235 cfs	8,170 cfs	7,400 cfs		11,500 cfs	
Disch Cap, Top of Multipurpose Pool	5,520 cfs	6,400 cfs	6,150 cfs		9,650 cfs	
Service Gates, Number and Size	2 - 6'x12'	2 - 6.5'x14'	2 - 5.33'x15.92'		2 - 6.5'x14'	
Emergency Gates, Number and Size	2 - 6'x12'	2 - 6.5'x14'	1 - 5.33'x15.92'		1 - 6.5'x14'	
Low Flow Gates, Number and Size	2 - 2'x2'	2 - 2'x2'	2 - 2'x2'	2 - 24" dia	1 - 24" Butterfly	
Provision for Power	None	None	None	3 - 20'x40'		12 - 17'x26.5'
POWER FACILITIES						
Generator Turbine Units, Number				1		6
Generator Name Plate Capacity, kw				45,200		160,000
Turbine Rating, hp				75,600 (56 ft head)		254,400
Turbine Type				Kaplan (Vertical Shaft)		Kaplan (Inclined Shaft)
Maximum (Full Pool) Head and Disch				112 ft (6,300 cfs)		79.2 ft (31,800 cfs)
Avg (Power & MP Pool) Head and Disch				85 ft (7,900 cfs)		42.5 ft (65,000 cfs)
Minimum Head and Disch				62 ft (11,000 cfs)		41 ft (68,000 cfs)
Reversible Pump Turbines				None		6
Total Dynamic Head, Feet						50
Disch. 5 Units at Max Head, cfs						27,500
Maximum Power Required, hp						197,000
Maximum Drawdown, Feet msl				845		704

REMARKS

(1) With pool at multipurpose level.
(2) Damming height is from valley floor to top of flood pool.
(3) Based on latest available storage data. Revised capacity tables placed in use
at the following projects:
Pomme de Terre, February 1985
Melvern, March 1986
Stockton, February 1988
Harry S. Truman, March 1995
Pomona, March 1990
(4) Total above Truman Reservoir is 11,500 square miles.

ac = acres
af = acre-feet
ft = feet
msl = elevation above mean sea level
cfs = cubic feet per second
kw = kilowatts
hp = horsepower

SUMMARY OF ENGINEERING DATA
OSAGE RIVER BASIN PROJECTS

US Army Corps of Engineers
Kansas City District
December 1998

SUBJECT	SMITHVILLE LAKE	LONGVIEW LAKE	BLUE SPRINGS LAKE	RATHBUN LAKE	LONG BRANCH LAKE
GENERAL					
Location of Dam	Near Smithville, MO	Kansas City, MO	Kansas City, MO	Rathbun, Iowa	Macon Mo
Stream / River	Little Platte River	Little Blue River	East Fork Little Blue River	Chariton River	East Fork Little Chariton R.
Miles above Mouth	13.6	42.9	28.8	142.3	78
Contributing Drainage Area, Sq Miles	213	50.3	32.8	549	109
Approx Length of Full Reservoir, Miles	18	3.5	2.5	14	9
Shoreline, Miles (1)	175	24	12	155	24.2
Max Disch of Record Near Damsite	76,600 cfs (20 July 1965)	18,700 cfs (13 August 1982)	11,000 cfs (13 August 1982)	21,800 cfs (31 March 1960)	30,000 cfs (21 April 1973)
Date of Closure	13 July 1976	16 June 1983	12 August 1986	29 September 1967	3 September 1976
Date Storage Began	19 October 1979	16 September 1985	27 September 1988	21 November 1969	2 August 1978
Multipurpose Level Reached	11 June 1982	21 September 1986	18 March 1990	10 October 1970	19 May 1981
Operating Agency	Corps of Engineers	Corps of Engineers	Corps of Engineers	Corps of Engineers	Corps of Engineers
DAM AND EMBANKMENT					
Top of Dam Elevation, Feet msl	895	926.6	840	946	826
Length of Dam, Feet (net)	4,000	1,900	2,500	10,600	3,550
Damming Height, Feet (2)	80.2	110	70	82	71
Type of Fill	Rolled Earth	Earth	Earth and Rock	Rolled Earth	Rolled Earth
Fill Quantity, cubic yards	3,200,000	2,500,000	1,200,000	4,700,000	1,855,000
SPILLWAY					
Location	Right Abutment	Left Abutment	Left Abutment	Right Abutment	Right Abutment
Crest Elevation, Feet msl	880.2	911.3	823.6	926	809
Width, Feet	50	200	300	500	50
Number, Size, and Type of Gates	None	None	None	None	None
Discharge Cap, Top of Surcharge Pool	4,800 cfs	22,800 cfs	37,800 cfs	45,600 cfs	7,900 cfs
RESERVOIR (3)					
Surcharge Pool Elevation and Area	891 ft msl 14,611 ac	922.9 ft msl 3,207 ac	837.7 ft msl 1,200 ac	940 ft msl 29,475 ac	820.7 ft msl 6,527 acres
Flood Control Pool Elevation and Area	876.2 ft msl 9,990 ac	909 ft msl 1,964 ac	820.3 ft msl 982 ac	926 ft msl 20,974 ac	801 ft msl 3,663 ac
Multipurpose Pool Elevation and Area	864.2 ft msl 7,115 ac	891 ft msl 927 ac	802 ft msl 722 ac	904 ft msl 10,989 ac	791 ft msl 2,429 ac
Recreation Pool Elevation & Area		870 ft msl 432 ac			
Surcharge Storage	(891 - 876) 182,198 af	(922.7 - 909) 35,370 af	(837.7 - 820.3) 19,039 af	(940 - 926) 349,499 af	(820.7 - 801) 98,596 af
Flood Control Storage	(876 - 864) 101,777 af	(909 - 891) 24,810 af	(820.3 - 802) 15,715 af	(926 - 904) 345,791 af	(801 - 791) 30,327 af
Multipurpose Storage	(864 - 799) 141,686 af	(891 - 870) 13,579 af	(802 - 760) 10,842 af	(904 - 855) 199,830 af	(791 - 751.1) 34,189 af
Recreation Storage		(870 - 810.4) 8,555 af			
Sediment Reserve Storage	52,300 af	2,000 af	300 af	24,000 af	4,000 af
Gross Storage	(876 - 799) 243,443 af	(909 - 810.4) 46,944 af	(820.3 - 760.1) 26,557 af	(926 - 855) 545,621 af	(801 - 751) 64,516 af
Estimated Annual Sediment Inflow	523 af 100 years	20 af 100 years	3 af 100 years	240 af 100 years	40 af 100 years
OUTLET WORKS					
Location	Right Abutment	Left Abutment	Right Abutment	Right Abutment	Right Abutment
River Outlet Type	Rectangular Conduit	Concrete Arch	Arch Conduit	Horseshoe Conduit	Concrete Arch
Number and Size of Conduit	1 - 8’x9’	1 - 5.5’x5’	1 - 3.5’x4.75’	1 - 11’	1 - 6’x5.5’
Length of Conduit, Feet	696	916		539	450
Entrance Invert Elevation	805 ft msl	816 ft msl	768.5 ftmsl	855 ft msl	760 ft msl
Drop Inlet Crest Elevation		891	802 ft msl		
Low Flow Gate Intake Elevation		875 - 861	791.5		
Disch Cap, Top of Surcharge Pool	3,490 cfs	1,270 cfs	6 cfs	5,680 cfs (4)	1,150 cfs
Disch Cap, Top Flood Control Pool	3,150 cfs	1,200 cfs	570 cfs	5,160 cfs (4)	910 cfs
Disch Cap, Top of Multipurpose Pool	2,940 cfs		-	4,240 cfs (4)	495 cfs
Service Gates, Number and Size	2 - 4.25’x9.25’ Slide		-	2 - 6’x12’ HS	2 - 24” Slide
Emergency Gates, Number and Size	2 - 4.25’x9.25’ Slide	1 - 6’x7’	1-4.5’x5’	2 - 6’x12’ HS	1 - 6’x6’
Low Flow Gates, Number, Size, Type		2 - 24” Knife Valves	1-2’ Knife Valve		
Low Flow Gates, Number and Size	1 - 2’x2’	2 - 24” Knife Valves	1-2’ Knife Valve	2 - 2’ x2’ HS	1 - 18” Slide
Provision for Water Supply	1 - 5.75’ Pipe				
Provision for Power	None	None	None	None	None

REMARKS

(1) With pool at multipurpose level.
(2) Damming height is from valley floor to top of flood control pool.
(3) Based on latest available storage data. Revised area capacity data was placed in use at the following projects:
Smithville Lake, March 1990
Long Branch Lake, October 1989
(4) Only with special approval from the water control office may the Rathbun outlet works exceed a discharge rate of 1,800 cfs. Flow above 1,800 cfs results in overtopping of the outlet works stilling basin walls.

ac = acres
af = acre-feet
ft = feet
msl = elevation above mean sea level
cfs = cubic feet per second

SUMMARY OF ENGINEERING DATA
LOWER MISSOURI RIVER BASIN
PROJECTS

US Army Corps of Engineers
Kansas City Distict
December 1998

SUBJECT	MILFORD LAKE	TUTTLE CREEK LAKE	PERRY LAKE	CLINTON LAKE	TOTALS	REMARKS
GENERAL						(1) With pool at multipurpose level. (2) Damming height is from valley floor to top of flood control pool. (3) Based on latest available storage data. Revised area - capacity data was placed in use at the following projects: Perry Lake, October 1990 Tuttle Creek Lake, January 1984 (4) Total drainage area above Milford is 38,621 square miles. ac = acres af = acre-feet ft = feet msl = elevation above mean sea level cfs = cubic feet per second .
Location of Dam	Near Junction City, KS	Near Manhatten, KS	Near Perry, KS	Near Lawrence, KS		
Stream / River	Republican River	Big Blue River	Delaware River	Wakanusa River		
Miles above Mouth	7.7	10	5.3	22.2		
Contributing Drainage Area, Sq Miles	17,388 (4)	9,628	1,117	367		
Approx Length of Full Resv, Miles	30	50	20	17		
Shoreline, Miles (1)	163	112	160	82		
Max Disch of Record near Damsite	171,000 cfs (3 June 1935)	98,000 cfs (June 1951)	94,600 cfs (June 1951)	24,200 cfs (July 1951)		
Date of Closure	24 August 1964	20 July 1959	2 August 1966	23 August 1975		
Date Storage Began	16 January 1967	7 March 1962	15 January 1969	30 November 1977		
Multipurpose Level Reached	14 July 1967	30 April 1963	3 June 1970	3 April 1980		
Operating Agency	Corps of Engineers	Corps of Engineers	Corps of Engineers	Corps of Engineers		
DAM AND EMBANKMENT						
Top of Dam Elevation, Feet msl	1,213	1,159	946	928		
Length of Dam, Feet (net)	6,300	7,487	7,750	9,250		
Damming Height, Feet (2)	110.2	134	95	114		
Type of Fill	Earth	Earth, Rock	Earth	Earth		
Fill Quantity, cubic yards	15,000,000	21,000,000	8,000,000	10,423,000		
SPILLWAY						
Location	Right Abutment	Left Abutment	Left Abutment	Left Abutment		
Crest Elevation, Feet msl	1,176.2	1,116	922	907.4		
Width, Feet	1,250	1,059	300	500		
Number, Size, and Type of Gates	None	18 - 40’x20’ Tainter	None	None		
Disch Cap, Top of Surcharge Pool	560,000 cfs	579,000 cfs	65,000 cfs	44,200 cfs		
RESERVOIR (3)						
Surcharge Pool Elevation and Area	1,208.2 ft msl 59,886 ac	1,151.4 fr msl 70,193 ac	941.2 ft msl 42,656 ac	921.4 ft msl 18,336 ac	191,071 ac	
Flood Control Pool Elev and Area	1,176.2 ft msl 32,979 ac	1,136 ft msl 54,179 ac	920.6 ft msl 25,364 ac	903.4 ft msl 12,891 ac	125,413 ac	
Multipurpose Pool Elev and Area	1,144.4 ft msl 15,709 ac	1,075 ft msl 13,350 ac	891.5 ft msl 11,158 ac	875.5 ft msl 7,006 ac	47,223 ac	
Surcharge Storage	(1208.2 - 1176.2) 1,442,049 af	(1,151.4 - 1,136) 957,370 af	(941.2 - 920.6) 692,374 af	(921.4 - 903.4) 285,809 af	3,377,602 af	
Flood Control Storage	(1176.2 - 1144.4) 756,669 af	(1,136 - 1,075) 1,922,085 af	(920.6 - 891.5) 515,961 af	(903.4 - 875.5) 268,367 af	3,463,082 af	
Multipurpose Storage	(1144.4 - 1080) 388,816 af	(1,075 - 1,010) 335,100 af	(891.5 - 835) 209,548 af	(875.5 - 820) 129,171 af	1,062,635 af	
Sediment Reserve Storage	160,000 af	233,000 af	140,000 af	28,500 af	561,500 af	
Gross Storage	(1,176.2 - 1080) 1,145,485 af	(1,136 - 1,010) 2,257,185 af	(920.6 - 835) 725,509 af	(903.4 - 820) 397,538 af	4,525,717 af	
Estimated Annual Sediment Inflow	1,600 af 100 years	4,700 af 50 years	1,400 af 100 years	285 af 100 years		
OUTLET WORKS						
Location	Right Abutment	Right Abutment	Near Center of Dam	Left Abutment		
River Outlet Type	Gated Conduit	Gated Conduit	Gated Conduit	Gated Conduit		
Number and Size of Conduit	1 - 21’	2 - 20’	1 - 23.5’	1 - 12.5’x13’ Arch		
Length of Conduit, Feet	615.5	860	592	710		
Entrance Invert Elevation	1,080 ft msl	1,003 ft msl	833 ft msl	828 ft msl		
Gated Sluice, Number and Size	None	None	None	None		
Disch Cap, Top of Flood Control Pool	23,100 cfs	45,900 cfs	27,500 cfs	7,570 cfs		
Disch Cap, Top of Multipurpose Pool	18,600 cfs	31,300 cfs	21,200 cfs	5,900 cfs		
Service Gates, Number and Size	2 - 10.5’x21’	4 - 10’x20’	2 - 11.75’x23.5’	2 - 6.33’x12.67’		
Emergency Gates, Number and Size	2 - 10.5’x21’	1 - 10’x20’	2 - 11.75’x23.5’	1 - 6.33’x12.67’		
Low Flow Gates, Number and Size	2 - 2’x2’	2 - 24” Butterfly Valve	2 - 2’x2’	1 - 24” Knife Gate Value		
Water Supply Gate, Number and Size	None	None	None	1 - 54”x54” Slide Gate		
Provision for Irrigation	None	None	None	None		
Provision for Power	None	None	None	None		
Provision for Water Supply	None	None	None	36” Steel Pipe		

SUMMARY OF ENGINEERING DA
LOWER KANSAS RIVER BASIN PRO.
US. Army Corps of Engineers
Kansas City District
December 1998

SUBJECT	BONNY RESERVOIR	SWANSON LAKE	ENDERS RESERVOIR	HUGH BUTLER LAKE	HARRY STRUNK LAKE	KEITH SEBELIUS LAKE	HARLAN COUNTY LAKE	LOVEWELL RESERVOIR	REMARKS
GENERAL									
Location of Dam	Near Hale, CO	Near Trenten, NE	Near Enders, NE	Near McCook, NE	Near Cambridge, NE	Near Norton, KS	Nr Republican City, NE	Near Lovewell, KS	(1) With pool at. multipurpose level.
Stream / River	South Fork Republican R.	Republican River	Frenchman Creek	Red Willow Creek	Medicine Creek	Prairie Dog Creek	Republican River	White Rock Creek	
Miles above Mouth	60.4	359	81.7	18.7	11.9	74.9	232.3	19.3	(2) Damming height is from valley floor to top of flood control pool.
Contributing Drainage Area, Sq Miles	1,435	3,941	786	310	642	688	13,536	358	
Approx Length of Full Resv, Miles	5.5	9.0	6.0	7.5	8.5	9.5	17	11	
Shoreline, Miles (1)	15.0	30	26	35	29	32	54	44	
Max. Disch. of Record near Damsite	103,000 (31 May 1935)	200,000 (31 May 1935)	Insuficient Data	30,000 (22 Jun 1947)	120,000 (June 1947)	37,500 (28 May 1953)	260,000 (1 Jun 1935)	23,300 (10 July 1950)	(3) Based on latest available storage data. Revised area capacity data was placed in use at the following lakes: Milford, 1983 Swanson, 1984 Harry Strunk, 1983 Harlan County, 1989 Lovewell, 1997
Date of Closure	6 July 1950	4 May 1953	23 October 1950	5 September 1961	8 August 1949	28 January 1964	22 July 1951	29 May 1957	
Date Storage Began	6 July 1950	4 May 1953	23 October 1950	5 September 1961	8 August 1949	5 October 1964	14 November 1952	2 October 1957	
Multipurpose Level Reached	19 March 1954	15 May 1957	29 January 1952	21 May 1967	2 April 1951	21 June 1967	14 June 1957	20 May 1958	
Operating Agency	Bureau of Reclamation	Bureau of Reclamation	Bureau of Reclamation	Bureau of Reclamation	Bureau of Reclamation	Bureau of Reclamation	Corps of Engineers	Bureau of Reclamation	
DAM AND EMBANKMENT									
Top of Dam Elevation, Feet msl	3,742.0	2,793.0	3,137.5	2,634.0	2,415.0	2,347.0	1,982.0	1,616.0	
Length of Dam, Feet (Less Spillway)	9,141.5	8,600	2,242	3,159	5,665	6,344	11,830	8,392	
Damming Height, Feet (2)	93.0	80.0	93.0	About 85	86	85.5	98.5	70.3	
Type of Fill	Earth	Earth	Earth	Earth	Earth	Earth	Earth	Earth	
Fill Quantity, cubic yards	8,853,000	8,130,000	1,950,000	3,122,000	2,730,000	3,740,000	13,400,000	3,000,000	(4) Circular morning glory inlet.
SPILLWAY									
Location	Left Abutment	Left Abutment	Right Abutment	Right Abutment	Left Abutment	Right Abutment	Center of Dam	Right Abutment	(5) Spillway also has one 10’ x 14.7’ uncontrolled notch.
Crest Elevation, Feet msl	3,710.0	2,743.0	3,097.0	2,604.9	2,366.1 (8)	2,296.0	1,943.5	1,575.3	
Width, Feet	121.5	142	361	31.5 (4)	229	106	856	50	
Number, Size, and Type of Gates	(6)	3 - 42’ x 30’ Radial	6 - 50’ x 30’ Radial (5)	None	None	3 - 30’x36.35’ Radial	18 - 40’x30’ Radial	2 - 25’x20’ Radial	(6) Spillway is an uncontrolled notch with a gated sluice below the spillway.
Disch Cap, Top of Surcharge Pool	73,300 cfs	126,000 cfs	200,000 cfs	4,910 cfs	97,800 cfs	96,000 cfs	480,000 cfs	35,000 cfs	
RESERVOIR (3)									
Surcharge Pool Elevation and Area	3,736.2 ft msl 8,579 ac	2,785 ft msl 10,035 ac	3,129.5 ft msl 2,557 ac	2,628.0 ft msl 4,084 ac	2,408.9 ft msl 5,784 ac	2,341 ft ft msl 6,713 ac	1,975.5 ft msl 24,135 ac	1,610.3 ft msl 7,635 ac	
Flood Control Pool Elev and Area	3,710 ft msl 5,036 ac	2,773 ft msl 7,940 ac	3,127.0 ft msl 2,405 ac	2,604.9 ft msl 2,682 ac	2,386.2 ft msl 3,483 ac	2,331.4 ft msl 5,316 ac	1,973.5 ft msl 22,820 ac	1,595.3 ft msl 5,024 ac	(7) Provision for
Multipurpose Pool Elev and Area							1,946 ft msl 13,262 ac		storage releases to the river is through the nine gated flood control sluices and one 18” low flow outlet in monolith 20. (8) Crest elevation of uncontrolled notch. Project also has an uncontrolled chute with crest elevation of 2386.2. (9) Also has a gated wasteway with one 10’ x 9’ gate from the canal outlet to the stilling basin.
Active Conservation Pool Elev, Area	3,672 ft msl. 2,042 ac	2,752 ft msl 4,922 ac	3,112.3 ft msl 1,707 ac	2,581.8 ft msl 1,629 ac	2,366.1 ft msl 1,840 ac	2,304.3 ft msl 2,181 ac		1,582.6 ft msl 2,987 ac	
Inactive Storage Pool Elev and Area	3,638 ft msl 331 ac	2,720 ft msl 1,411 ac	3,082.4 ft msl 658 ac	2,558.0 ft msl 787 ac	2,343 ft msl 701 ac	2,280.4 ft msl 587 ac		1,571.7 ft msl 1,495 ac	
Dead Storage Pool Elev and Area	3,635.5 ft msl 242 ac	2,710 ft msl 488 ac	3,080.0 ft msl 586 ac	2,552.0 ft msl 596 ac	2,335 ft msl 481 ac	2,275 ft msl 391 ac		1,562.07 ft msl 494 ac	
Surcharge Storage, af	(3,736 - 3,710) 178,230	(2,785 - 2,773) 107,670	(3,129.5 - 3,127) 6,210	(2,628.0-2,604.9) 76,788	(2,408.9-2,386.2) 105660	(2,341 - 2,331.4) 58,285	(1,975.5-1,973.5) 46,.947	(1,610.3-1,595.3) 94,140	
Flood Control Storage. af	(3,710 - 3,672) 128,820	(2,773 - 2,752) 134,077	(3,127 - 3,112.3) 29,770	(2,604.9-2,581.8) 48,851	(2,386.2-2,366.1) 52,715	(2,331.4-2,304.3) 98,803	(1,973.5-1,946) ,496,718	(1595.3 - 1582.6) 50,465	
Multipurpose Storage. af							(1,946 - 1,885) 315,090		
Sediment Reserve Storage, af							200,000 af		
Active Conservation Storage, af	(3,672 - 3,638) 39,206	(2,752 - 2,720) 99,784	(3,112 - 3,082.4) 34,512	(2,581.8 - 2,558) 27,326	(2,366.1 - 2,343) 26,846	(2,304.3-2,280.4) 30,651		(1,582.6-1,571.7) 24,022	
Inactive Storage. af	(3,638 - 3,635.5) 716	(2,720 - 2,710) 10,312	(3,082.4 - 3,080) 1,501	(2,558 - 2,552) 4,137	(2,343 - 2,335) 4,699	(2,880.4 - 2,275) 2,566		(1,571.7-1,562.07) 9,985	
Dead Storage. af	(3,635.5 - 3,617) 1,418	(2,710 - 2,693) 2,118	(3,080 - 3,042) 8,467	(2,552 - 2,511) 6,313	(2,335 - 2,318.5) 4,160	(2,275 - 2,247) 2,718		(1,562.07-1,535) 1,659	
Gross Storage, af	(3,710 - 3,617) 170,160	(2,773 - 2,693) 246,291	(3,127 - 3,042) 74,520	(2,604.9 - 2,511) 86,627	(2,386.2-2,318.5) 88,420	(2,331.4-2,247) 134,738	(1,973.5-1,885) 825,782	(1,595.3 - 1,535) 86,131	
Estimated Annual Sediment Inflow	160 af 50 years	1,020 af 50 years	400 af 50 year	200 af 50 years	150 af 50 years	120 af 50 years	2,000 af 100 years	Actual 6,024 af(1957-95)	
OULET WORKS									
Location	Left Abutment	Left Abutment	Right Abutment	Right Abutment	Right Abutment	Left Abutment	Center of Dam	Right Abutment	
River Outlet Type	Gated Conduit	Gated Conduit	Gated Conduit	Gated Conduit	Gated Conduit	Gated Conduit (4)	Gated Sluices	Spillway Gates (9)	
Number and Size of Conduit	1 - 26” at valve	2 - 6’ x 7.5’	1 - 7.0’	1 - 82”	1 - 44”	1 - 38”	(7)	None	
Lenth of Conduit, Feet	8,315	86.7	564.5	553.5	563.4	About 500		None	
Entrance Invert Elevation	3,635.5 ft msl	2,710 ft msl	3,080 ft msl	2,552 ft msl	2,335.0 ft msl	2,275 ft msl	1,885 ft msl		
Gated Sluice, Number and Size	1 - 16.5’ x 21.5’	None	None	None	None	None	9 - 5’ x 8’		ac = acres
Disch Cap, Top of Flood Control Pool	9,940 cfs	4,300 cfs	1,430 cfs	1,170 cfs	398 cfs (at Elev 2,379)	312 cfs	20,700 cfs		af = acre-feet
Disch Cap, Top of Multipurpose Pool	103 cfs	3,500 cfs	1,300 cfs	990 cfs	361 cfs	257 cfs	17,370 cfs		ft = feet
Service Gates, Number, Size, Type	None	2 - 6’ x 7.5’	None	2 - 3.5’ x 3.5’	1 - 3.25’ x 3.25’	1 - 2’9”x2’9”	9 - 5’ x 8’ Slide Gates		cfs = cubic feet per sec
Provision for Irrigation	32” x 3,930’ Conduit	1 - 56” dia Conduit	None	None	None	None	1 - 5.5’dia; 1-2.8’ dia Con	1 - 8’x10’ Gated Conduit	msl = elevation above
Provision for Power	None	None	None	None	None	None	12’x12’ Opening Plugged	None	mean sea level
Provision for Municipal Supply	None	None	None	None	None	1 - 16” Gated Conduit			

SUMMARY OF ENGINEERING DATA
REPUBLICAN RIVER BASIN PROJECTS
US. Army Corps of Engineers
Kansas City District
December 1998

SUBJECT	WACONDA LAKE	KIRWIN RESERVOIR	WEBSTER RESERVOIR	WILSON LAKE	KANOPOLIS LAKE	CEDAR BLUFF RESERVOIR	REMARKS
GENERAL							(1) With pool at multipurpose or conservation pool level. (2) Damming height is height from valley floor to top of flood control pool. (3) Based on latest available storage data. Revised area capacity data was placed in use at the following lakes: Kanopolis (1983), Wilson (1985), Kirwin & Webster (1998). (4) Located in the open spillway structure, flow begins at elevation 1720 ft msl. (5) Located under spillway crest, flow begins at elevation 2134.82 ft msl. (6) Located at center of spillway, flow begins at elevation 2144 ft msl. (7) In addition to the gated conduit, Kanopolis has an uncontrolled port. Discharges are with the uncontrolled port and two service gates fully open. (8) Provision was made for future installation of a steel penstock in the outlet tunnel. ac = acres af = acre-feet ft = feet msl = elevation above mean sea level cfs = cubic feet per second
Location of Dam	Near Glen Elder, KS	New Kirwin, KS	Near Stockton, KS	Near Wilson, KS	Near Ellsworth, KS	Near Ellis, KS	
Stream / River	Solomon River	North Fork Solomon River	South Fork Solomon River	Saline River	Smoky Hill River	Smoky Hill River	
Miles above Mouth	172.4	67.8	92.4	153.9	183.7	333.4	
Contributing Drainage Area, Sq Miles	5,076	1,367	1,150	1,917	7,860	5,365	
Approx Length of Full Resv, Miles	24	9	7	24	16	12.5	
Shoreline, Miles (1)	100	37	27	100	41	50	
Max Disch of Record near Damsite	125,000 cfs (July 1951)	24,000 cfs (September 1919)	55,200 cfs (July 1951)	25,700 cfs (Jul-Aug 1928)	61,000 cfs (June 1938)	98,000 cfs (May 1938)	
Date of Closure	18 October 1967	7 March 1955	3 May 1956	3 September 1963	26 July 1946	13 November 1950	
Date Storage Began	24 July 1968	5 October 1955	3 May 1956	29 December 1964	17 February 1948	13 November 1950	
Multipurpose Level Reached	16 May 1973	2 July 1957	18 June 1957	12 March 1973	19 July 1948	2 June 1951	
Operating Agency	Bureau of Reclamation	Bureau of Reclamation	Bureau of Reclamation	Corps of Engineers	Corps of Engineers	Bureau of Reclamation	
DAM AND EMBANKMENT							
Top of Dam Elevation, Feet msl	1,500.0	1,779.0	1,944.0	1,592.0	1,537.0	2,198.0	
Length of Dam, Feet (net less spillway)	14,631	12,246	10,604	5,600	15,360	12,409.5	
Damming Height, Feet (2)	107.9	95	84.7	152	131	102	
Type of Fill	Earth	Earth	Earth	Earth	Earth	Earth	
Fill Quantity, cubic yards	8,050,000	9,537,000	8,145,000	8,500,000	15,200,000	8,490,000	
SPILLWAY DATA							
Location	Right Abutment	Right Abutment	Left Abutment	Right Abutment	Right Abutment	Right Abutment	
Crest Elevation, Feet msl	1,467.4	1,757.3	1,884.6	1,582.0	1,507.0	2,166.0	
Width, Feet	644	400	116	450	500	150.5	
Number, Size, and Type of Gates	12 - 50’x21.76’ Radial	None	3 - 33’x39.51’ Radial	None	None	None	
Disch Cap, Top of Surcharge Pool	278,000 cfs	96,000 cfs	138,000 cfs	15,700 cfs	172,000 cfs	84,000 cfs	
RESERVOIR (3)							
Surcharge Pool Elevation and Area	1,492.9 ft msl 38,178 ac	1,773 ft msl 14,660 ac	1,938 ft msl 11,270 ac	1,587.5 ft msl 33,882 ac	1,531.8 ft msl 23,408 ac	2,192 ft msl 16,510 ac	
Flood Control Pool Elev and Area	1,488.3 ft msl 33,682 ac	1,757.3 ft msl 10,639 ac	1,923.7 ft msl 8,478 ac	1,554 ft msl 20,027 ac	1,508 ft msl 13,958 ac	2,166 ft msl 10,790 ac	
Multipurpose Pool Elev and Area				1,516 ft msl 9,045 ac	1,463 ft msl 3,406 ac		
Active Conservation Pool, Elev and Area	1,455.6 ft msl 12,602 ac	1,729.25 ft msl 5,071 ac	1,892.45 ft msl 3,797 ac			2,144 ft msl 6,869 ac	
Inactive Storage Pool, Elev and Area	1,428 ft msl 3,341 ac	1,697 ft msl 1,006 ac	1,860 ft msl 904 ac			2,107.8 ft msl 2,086 ac	
Dead Storage Pool, Elev and Area	1,407.8 ft msl 350 ac	1,693 ft msl 765 ac	1,855.5 ft msl 440 ac			2,090 ft msl 909 ac	
Surcharge Storage, af	(1,492.9-1,488.3) 164,966 af	(1,773 - 1,757.3) 198,467 af	(1,938 - 1,923.7) 140,912 af	(1,587.5 - 1,554) 894,263 af	(1,531.8 - 1,508) 438,655 af	(2,192 - 2,166) 353,230 af	
Flood Control Storage, af	(1,488.3-1,455.6) 722,315 af	(1,757.3-1,729.25) 215,136 af	(1,923.7-1,892.45) 183,353 af	(1,554 - 1,516) 530,204 af	(1,508 - 1,463) 369,278 af	(2,166 - 2,144) 191,860 af	
Multipurpose Storage, af				(1,516 - 1,435) 242,528 af	(1,463 - 1,430) 49,474 af		
Sediment Reserve Storage, af				40,000 af	51,500 af		
Active Conservation Storage, af	(1,455.6 - 1,428) 204,789 af	(1,729.25 - 1,697) 89,639 af	(1,892.45 - 1,860) 71,926 af			(2,144 - 2,107.8) 149,770 af	
Inactive Storage, af	(1,428 - 1,407.8) 35,435 af	(1,697 - 1,693) 3,546 af	(1,860 - 1,855.5) 2,975 af			(2,107.8 - 2,090) 27,059 af	
Dead Storage, af	(1,407.8 - 1,386) 1,236 af	(1,693 - 1,662.3) 4,969 af	(1,855.5 - 1,839) 1,256 af			(2,090 - 2,064) 8,261 af	.
Gross Storage, af	(1,488.3 - 1,386) 963,775 af	(1,757.3-1,662.3) 313,290 af	(1,923.7 - 1,839) 259,510 af	(1,554 - 1,435) 772,732 af	(1,508 - 1,430) 418,752 af	(2,166 - 2,064) 376,950 af	
Estimated Annual Sediment Inflow	475 af 50 years	Actual 1,281 af (1955-1996)	Actual 1,214 af (1956–1996)	400 af 100 years	1,030 af 50 years	260 af 50 years	
OUTLET WORKS							
Location	Left Abutment	Center of Dam	Right Abutment	Right Abutment	Right Abutment	Left Abutment	
River Outlet Type	Gated Conduit	Gated Conduit	Gated Conduit	Gated Conduit	Gated Conduit (7)	Gated Conduit	
Number & Size of Conduit	1 - 12.5’	1 - 7’	1 - 48”	1 - 12’	1 - 14’	1 - 5.5’	
Length of Conduit, Feet	575	About 500	538	1,152	2,443	863.5	
Entrance Invert Elevation	1,407.8 ft msl	1,693 ft msl	1,855.5 ft msl	1,450 ft msl	1,415 ft msl	2,090 ft msl	
Gated Sluice, Number and Size	None	15 - 5’x5’ (4)	None	None	None	8 - 5’x5’ (5)	
Orifice, Number and Size	None	None	None	None	None	Gated 1 - 14.5’x9.6’ (6)	
Disch Cap, Top of Flood Control Pool	5,200 cfs	15,350 cfs	480 cfs	6,500 cfs	6,400 cfs (7)	11,040 cfs	
Disch Cap, Top of Multipurpose Pool	4,000 cfs	4,050 cfs	385 cfs	5,300 cfs	4,500 cfs	3,524 cfs	
Service Gates, Number and Size	2 - 6.5’-8’	1 - 4’x5’	1 - 3.5’x3.5’	2 - 6’x12’	2 - 6’x12’	1 - 4’x5’	
Emergency Gates, Number and Size	1 - 9’x12’	1 - 4’x5’	1 - 3.5’x3.5’	2 - 6’x12’	1 - 6’x12’	1 - 4’x5’	
Low Flow Gates, Number and Size	None	None	None	2 - 2’x2’	None	None	
Provision for Irrigation	None	2 - 5.5’x8’	None	None	None	1 - 4’x5’	
Provision for Power	None	None	None	None	(8)	None	

SUMMARY OF ENGINEERING DATA
SMOKY HILL RIVER BASIN PROJECTS

U.S. Army Corps of Engineers
Kansas City District
December 1998

APPENDIX A
CORPS OF ENGINEERS PROJECTS

BLUE SPRINGS LAKE

CLINTON LAKE

HARLAN COUNTY LAKE

HARRY S. TRUMAN RESERVOIR

HILLSDALE LAKE

KANOPOLIS LAKE

LONG BRANCH LAKE

LONGVIEW LAKE

MELVERN LAKE

MILFORD LAKE

PERRY LAKE

POMME DE TERRE LAKE

POMONA LAKE

RATHBUN LAKE

SMITHVILLE LAKE

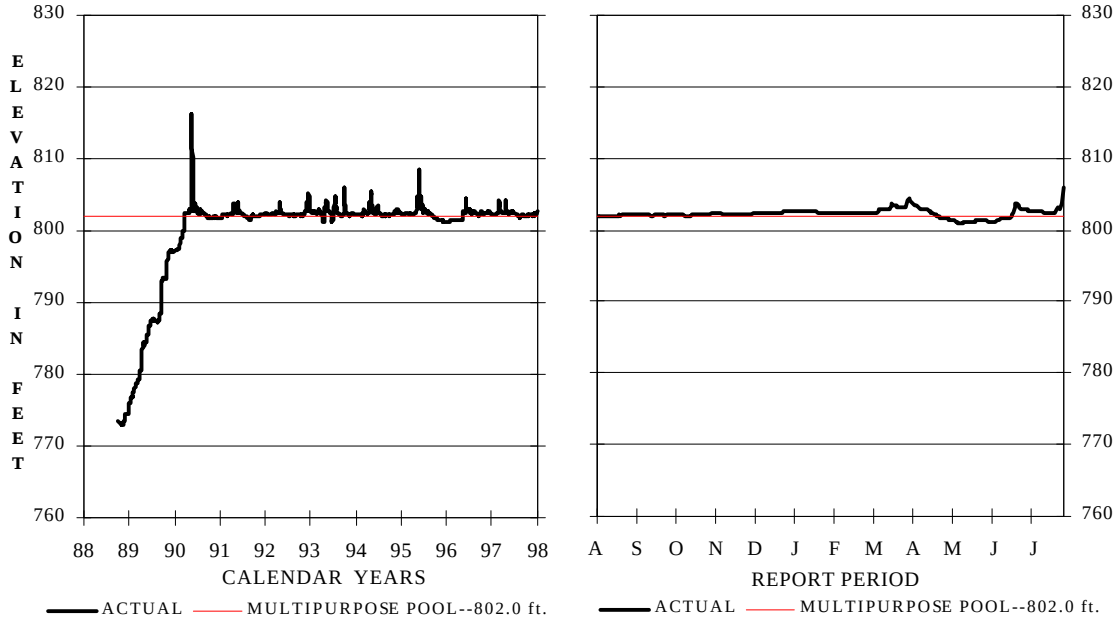
STOCKTON LAKE

TUTTLE CREEK LAKE

WILSON LAKE

BLUE SPRINGS LAKE
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



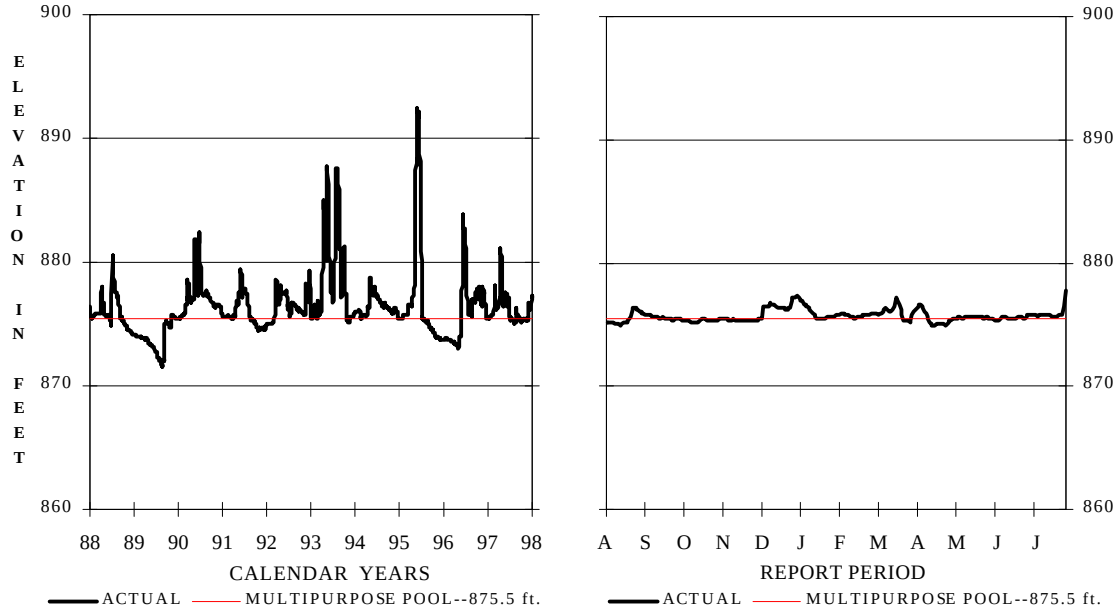
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
802.00 01 Aug 97	**805.87 31 Jul 98**	**805.87 31 Jul 98**	**800.92 11 May 98**	**816.4 17 May 90**	**800.92 11 May 98**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
1290 31 Jul 98	**27,232**	**60 24 Apr 98**	**0 Several Periods**

dsf = day-second-feet ac-ft = acre-feet

CLINTON LAKE
1997-98 REGULATION

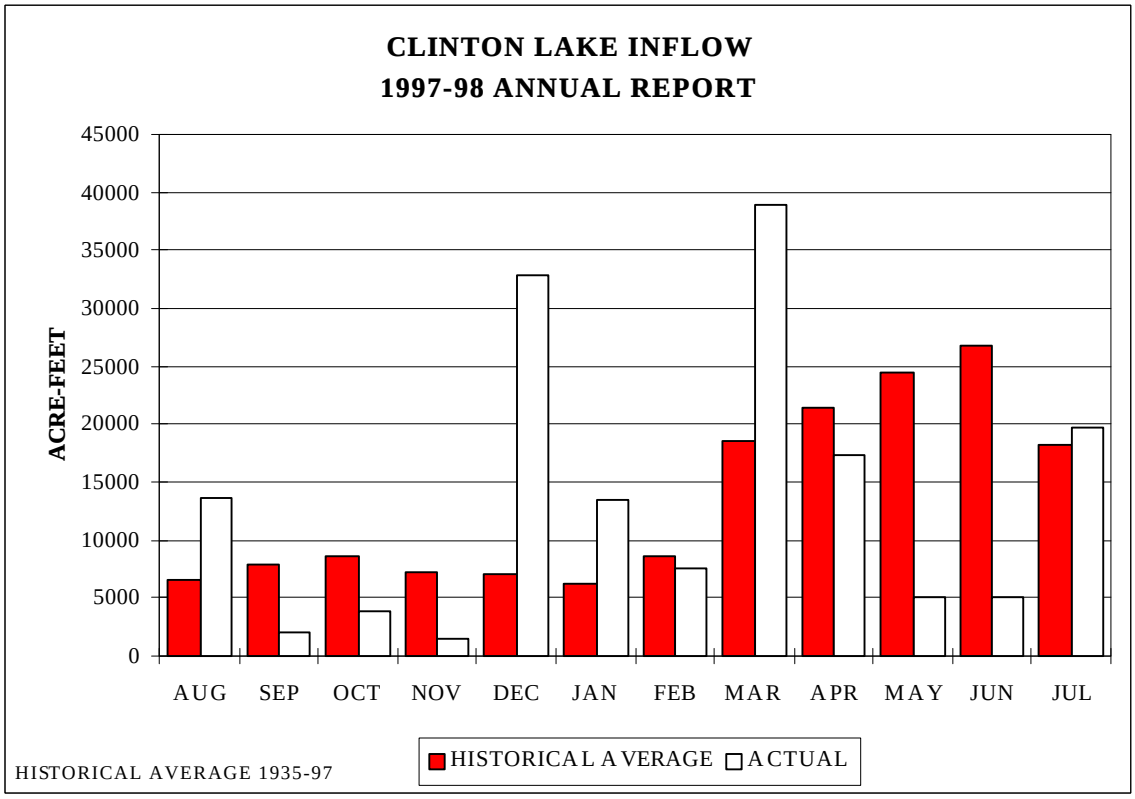
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
875.22 01 Aug 97	**877.81 31 Jul 98**	**877.81 31 Jul 98**	**874.92 16 Apr 98**	**892.46 30 May 95**	**871.60 18 Aug 89**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Low Flow dsf.
4,790 31 Jul 98	**161,049**	**2,000 20 Mar 98**	**0 17-22 Apr 98**

dsf = day-second-feet ac-ft = acre-feet


CLINTON LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
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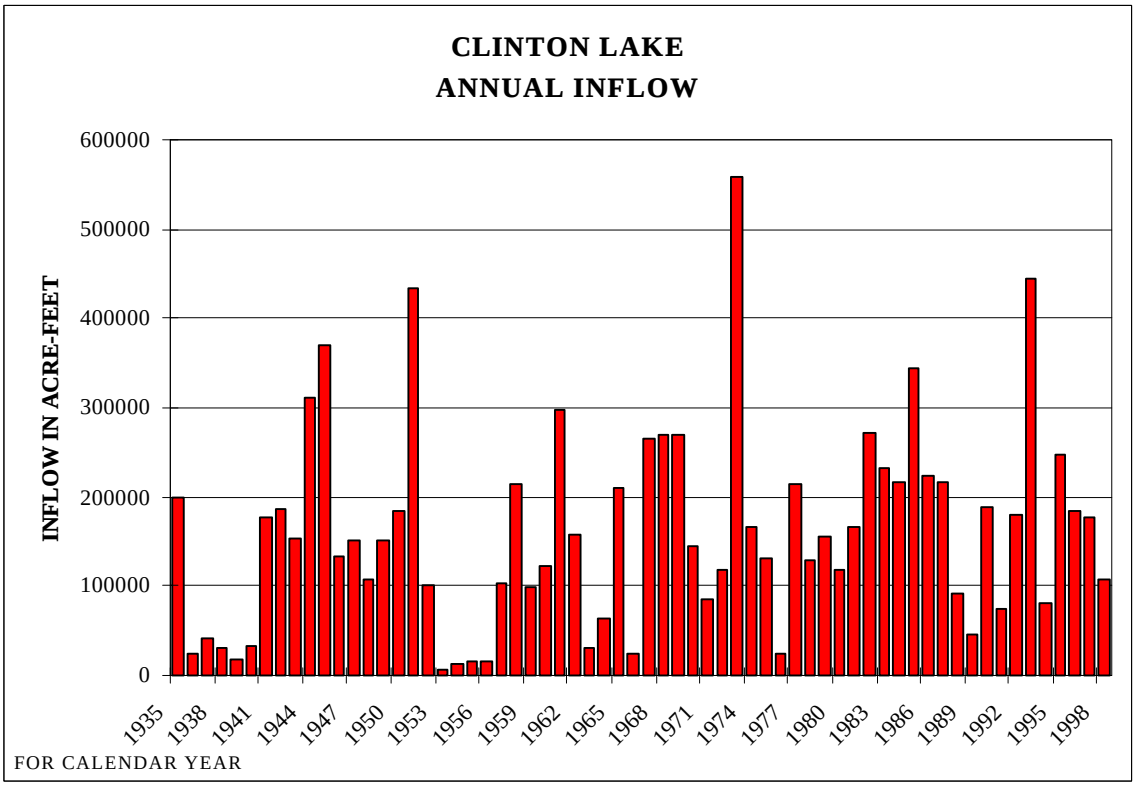
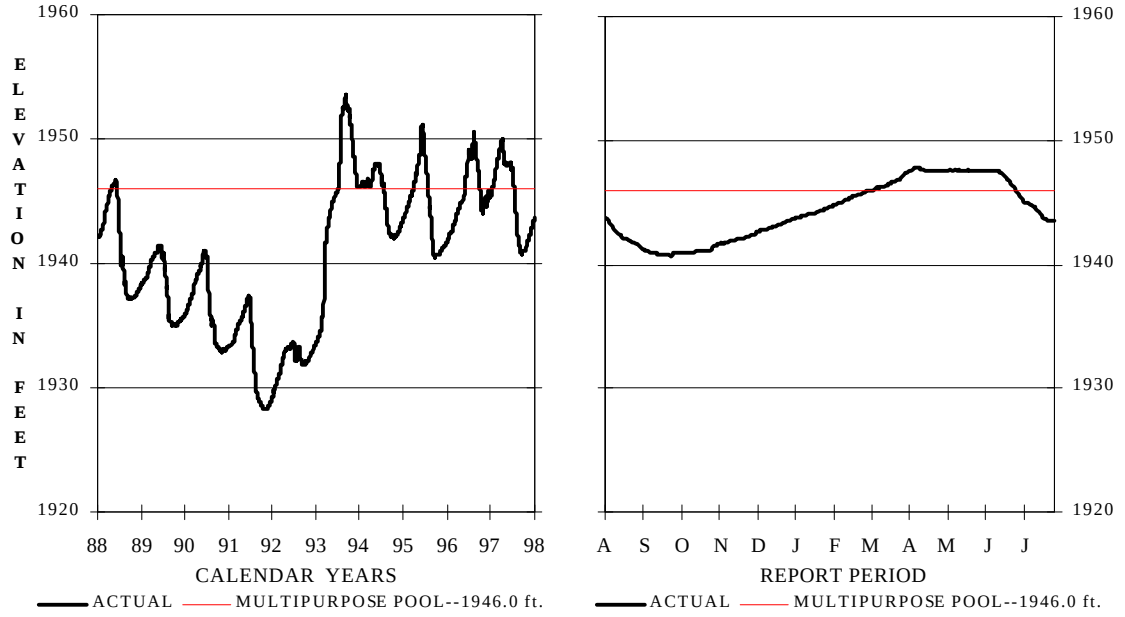
40000
35000
30000
25000
20000
15000
10000
5000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE
ACTUAL
HISTORICAL AVERAGE 1935-97


CLINTON LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
600000
500000
400000
300000
200000
100000
0
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
FOR CALENDAR YEAR

HARLAN COUNTY LAKE
1997-98 REGULATION

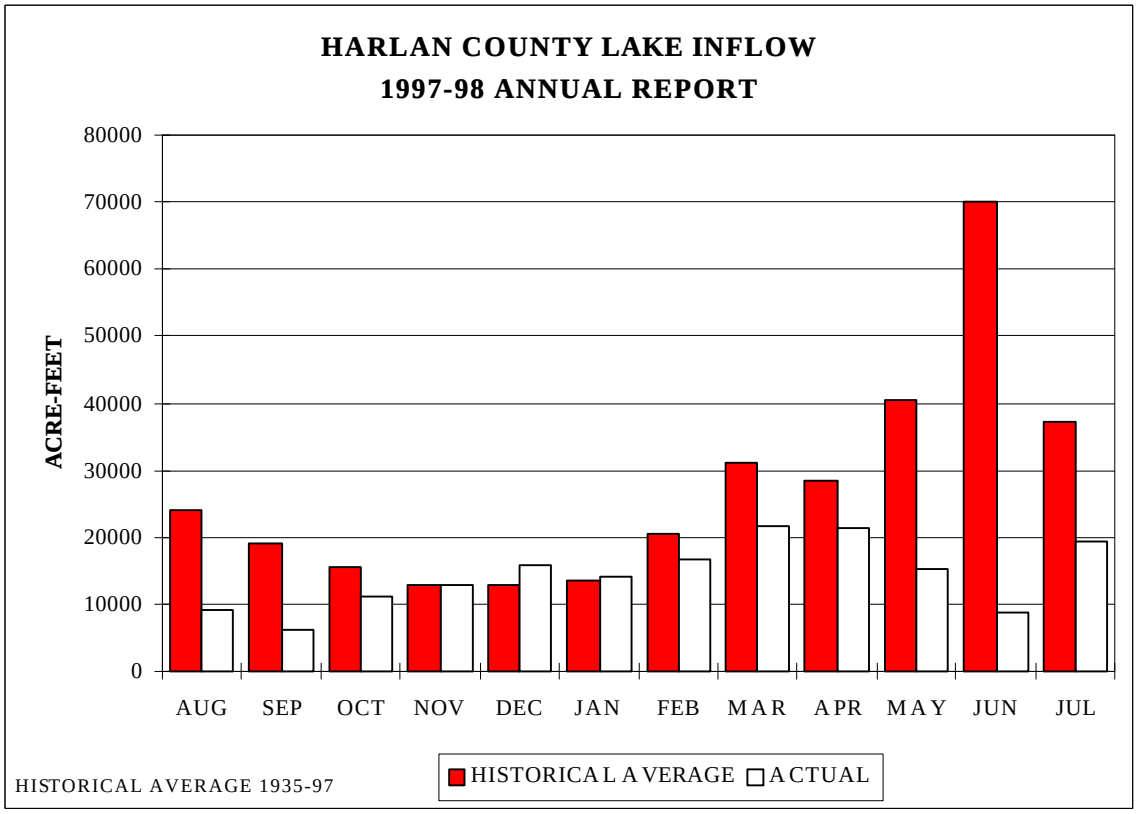
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

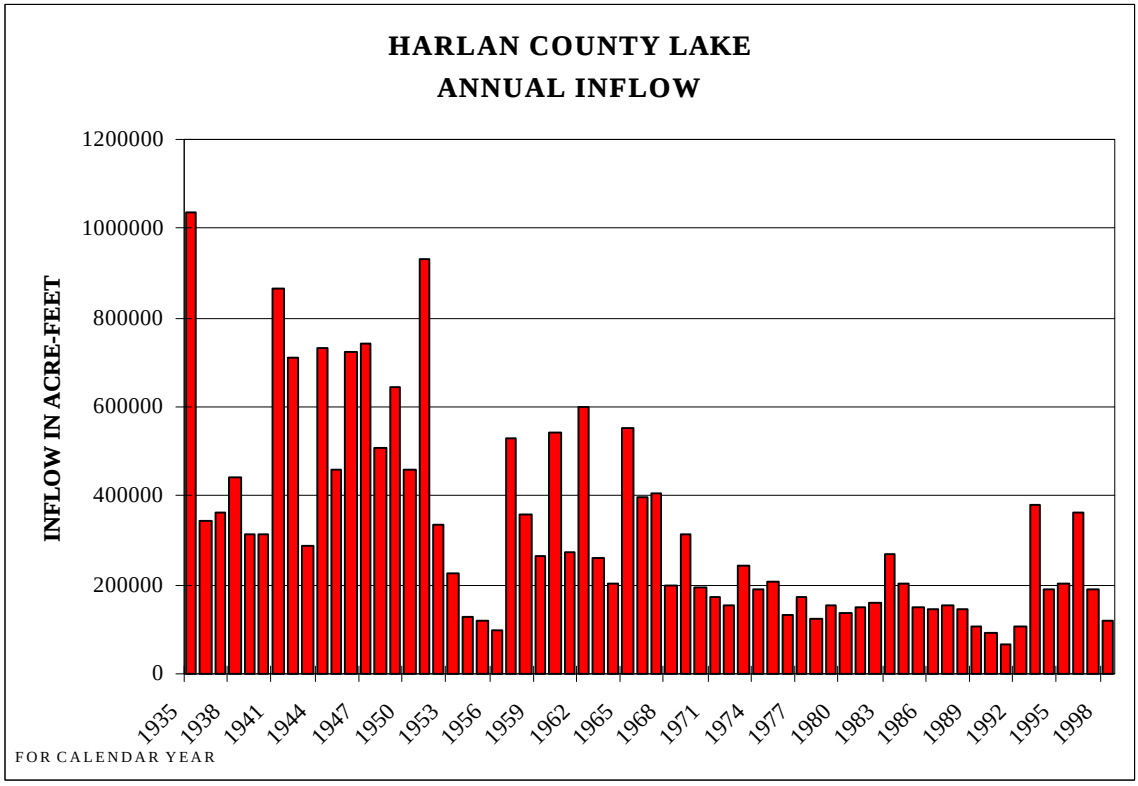


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1943.61 01 Aug 97	**1943.57 31 Jul 98**	**1947.82 09 Apr 98**	**1940.71 22 Sep 97**	**1955.67 09 Apr 60**	**1922.0 1953 22 Oct - 6 Nov**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
1,100 07 Apr 98	**172,451**	**700 1-7 Jul 98**	**0 5 Sep – 1 Dec 97**

dsf = day-second-feet ac-ft = acre-feet


HARLAN COUNTY LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
80000
70000
60000
50000
40000
30000
20000
10000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1935-97
HISTORICAL AVERAGE
ACTUAL


HARLAN COUNTY LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
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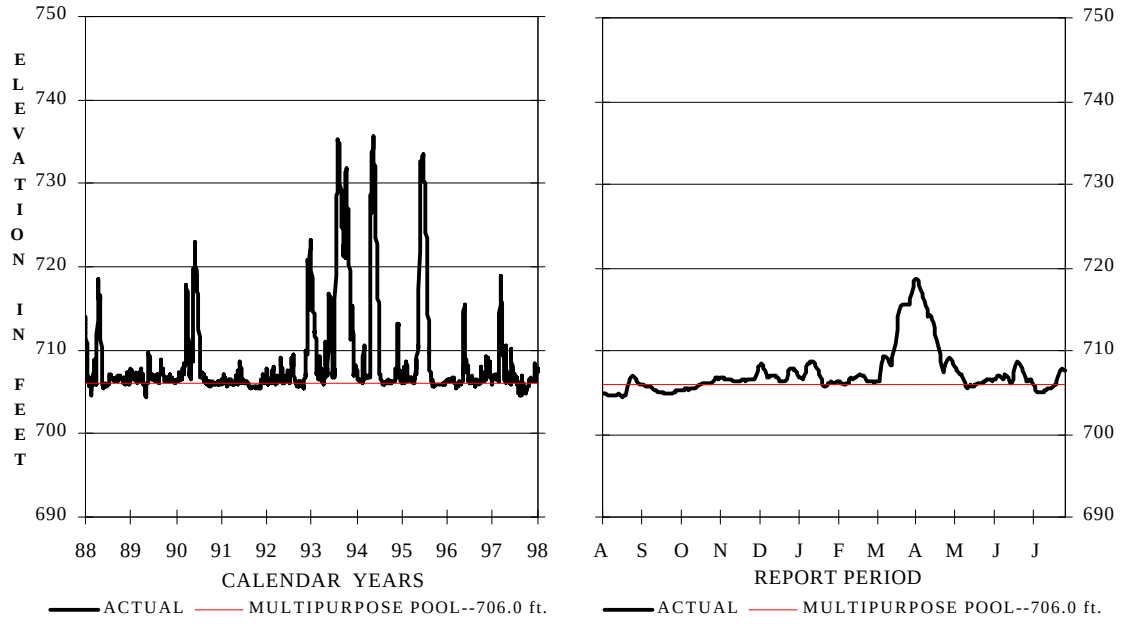
1000000
800000
600000
400000
200000
0
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
FOR CALENDAR YEAR

HARRY S. TRUMAN RES.
1997-98 REGULATION

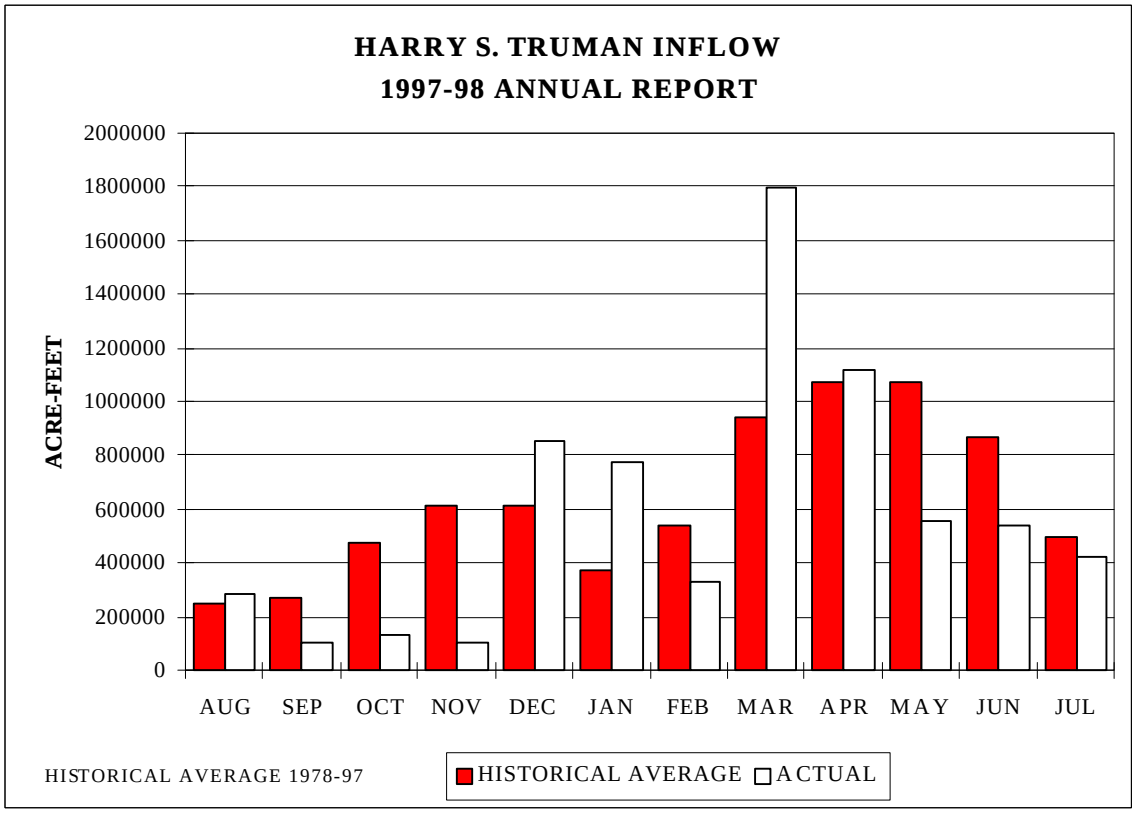
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

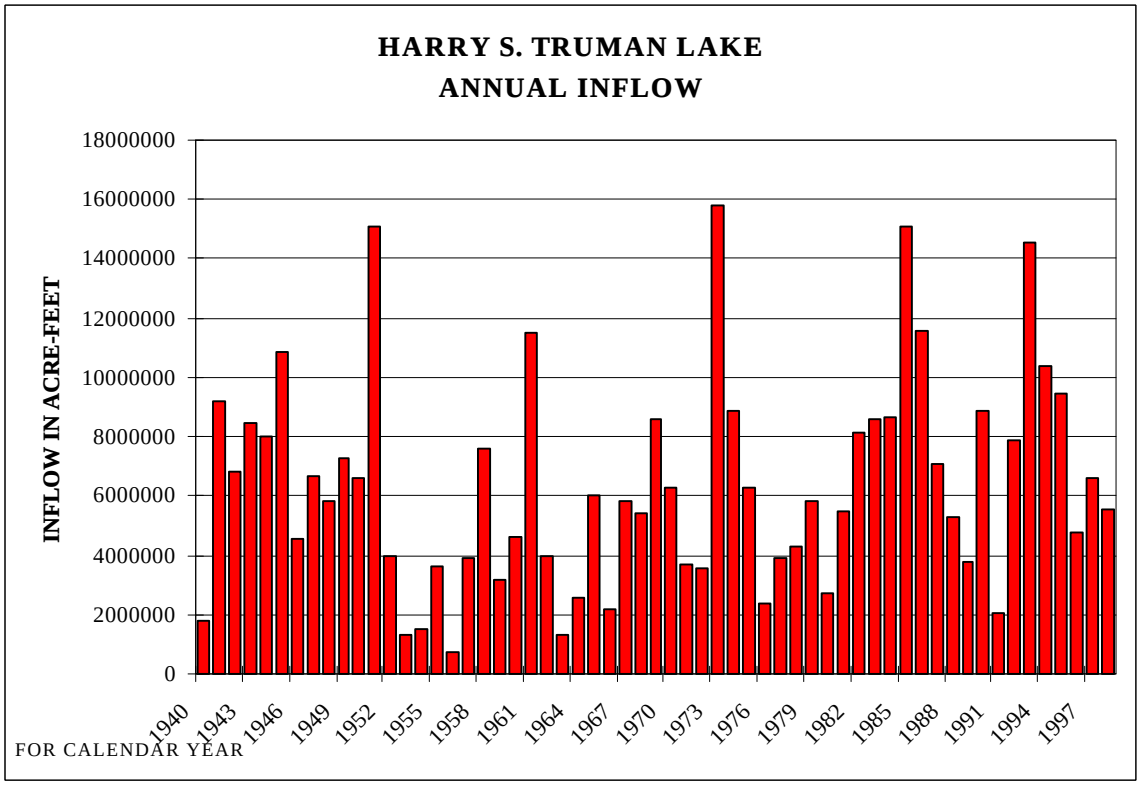


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
704.81 01 Aug 97	**707.58 31 Jul 98**	**718.54 05 apr 98**	**704.48 16 Aug 97**	**738.70 12 Oct 86**	**703.85 31 Dec 80**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
64,600 20 Mar 98	**7,021,151**	**500 Aug – Sep 97**	**0 Various Periods**

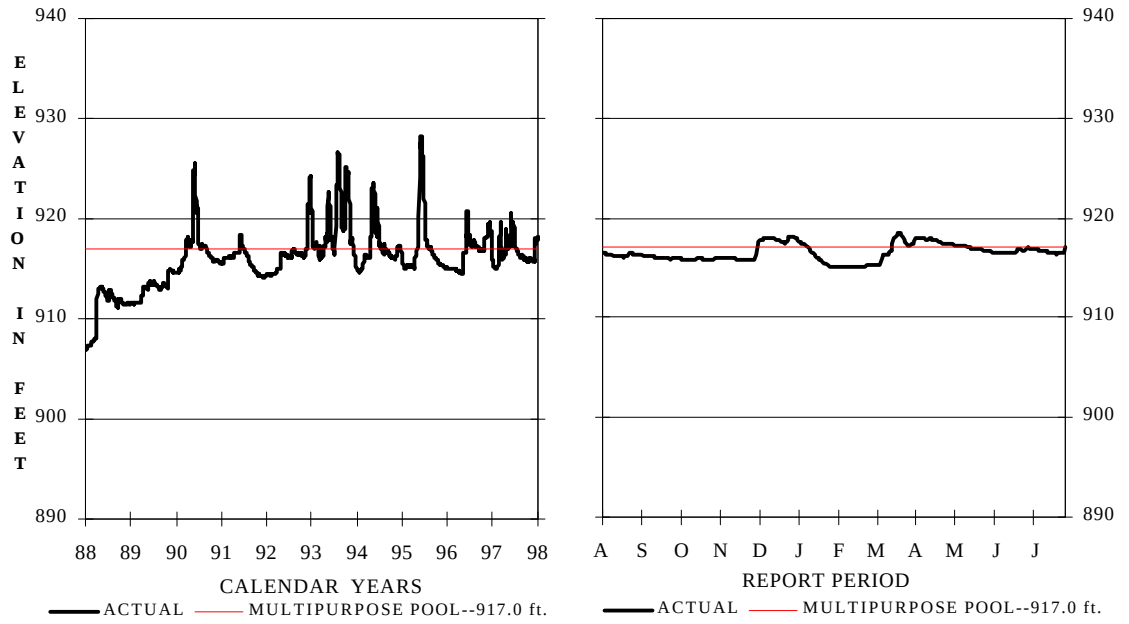
dsf = day-second-feet ac-ft = acre-feet


HARRY S. TRUMAN INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1978-97
HISTORICAL AVERAGE
ACTUAL


HARRY S. TRUMAN LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
18000000
16000000
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
FOR CALENDAR YEAR

HILLSDALE LAKE
1997-98 REGULATION

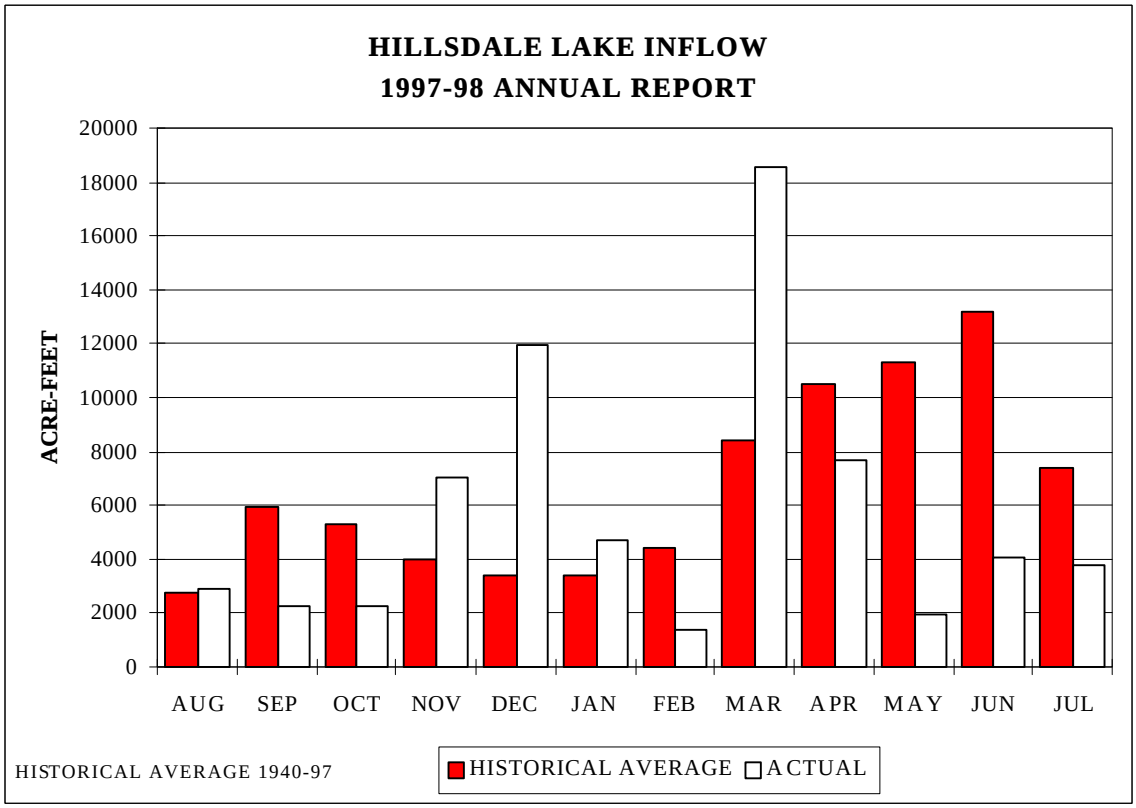
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

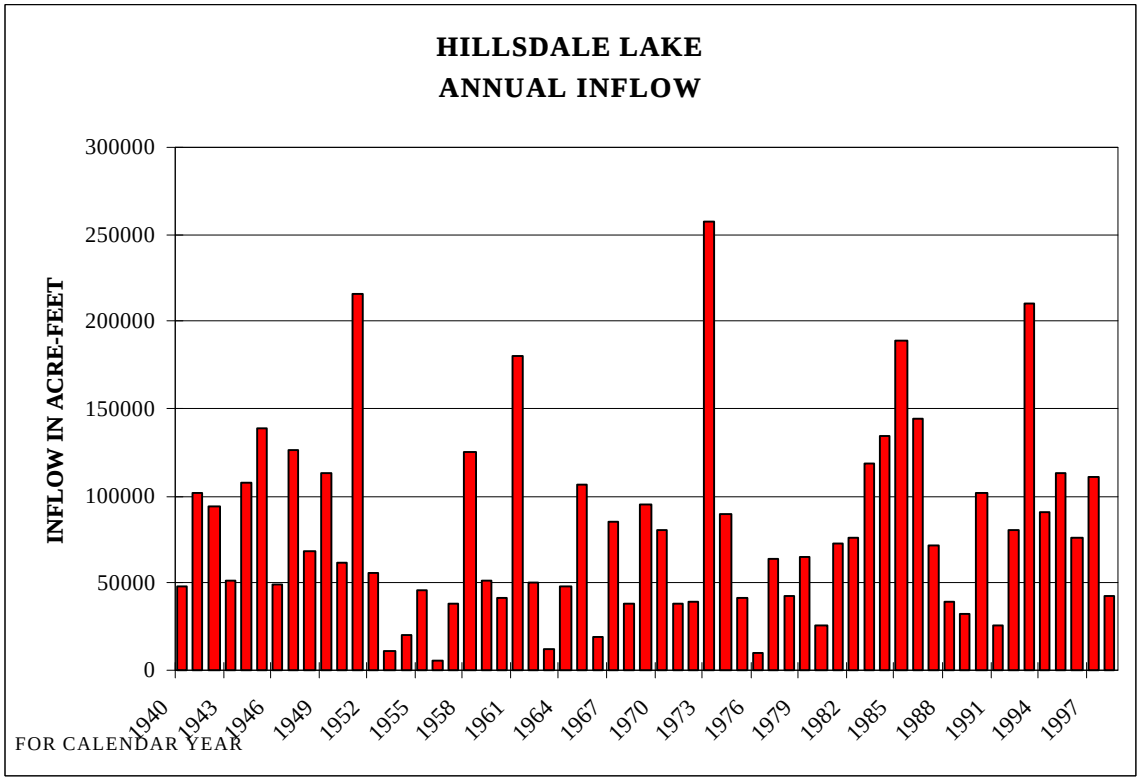


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
916.47 01 Aug 97	**917.02 31 Jul 98**	**918.56 22 Mar 98**	**915.08 27 Jan 98**	**928.51 21 Oct 86**	**905.00 15 Nov 87**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
2,250 30 Nov 97	**68,529**	**750 25 – 27 Mar 98**	**0 Several Periods**

dsf = day-second-feet ac-ft = acre-feet


HILLSDALE LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1940-97
HISTORICAL AVERAGE
ACTUAL


HILLSDALE LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
300000
250000
200000
150000
100000
50000
0
1940
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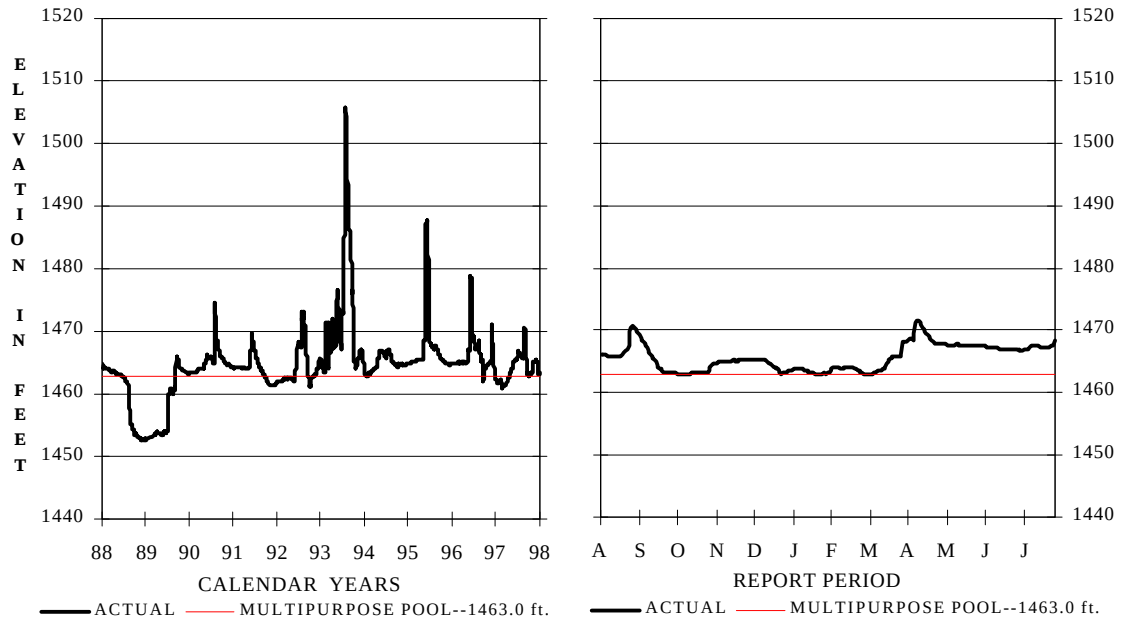
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
FOR CALENDAR YEAR

KANOPOLIS LAKE
1997-98 REGULATION

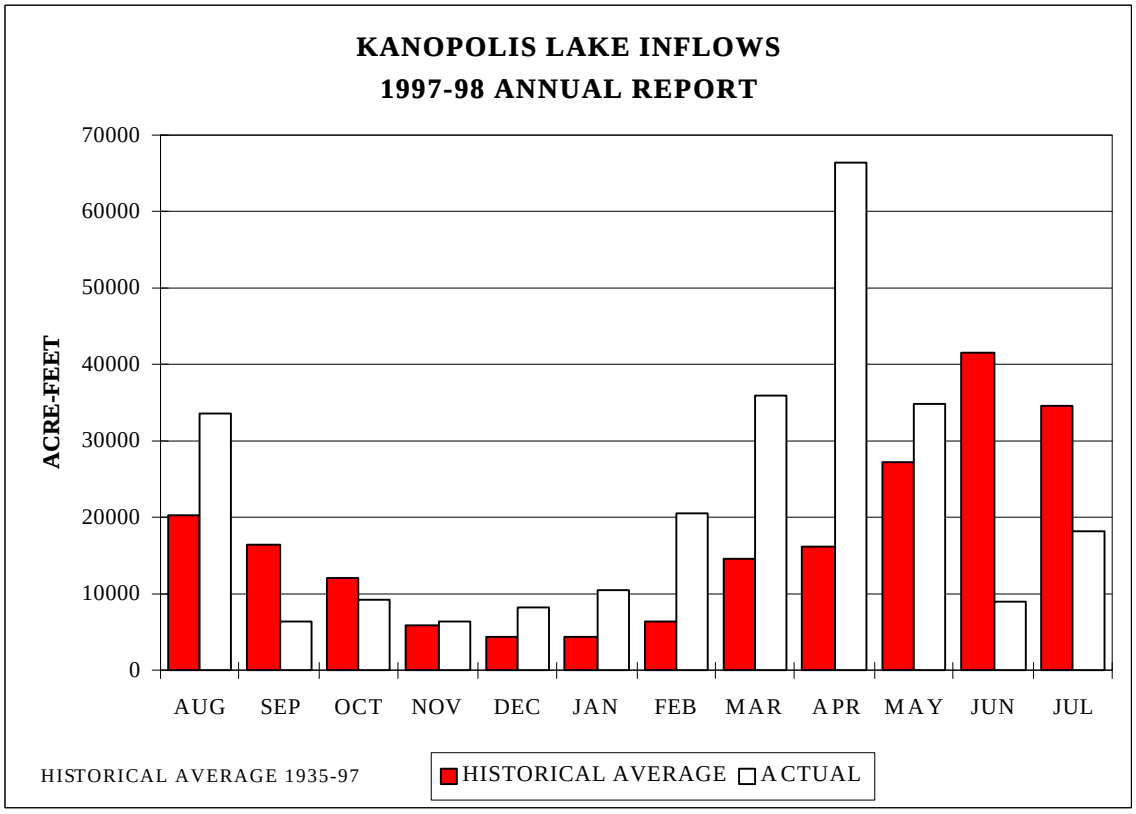
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

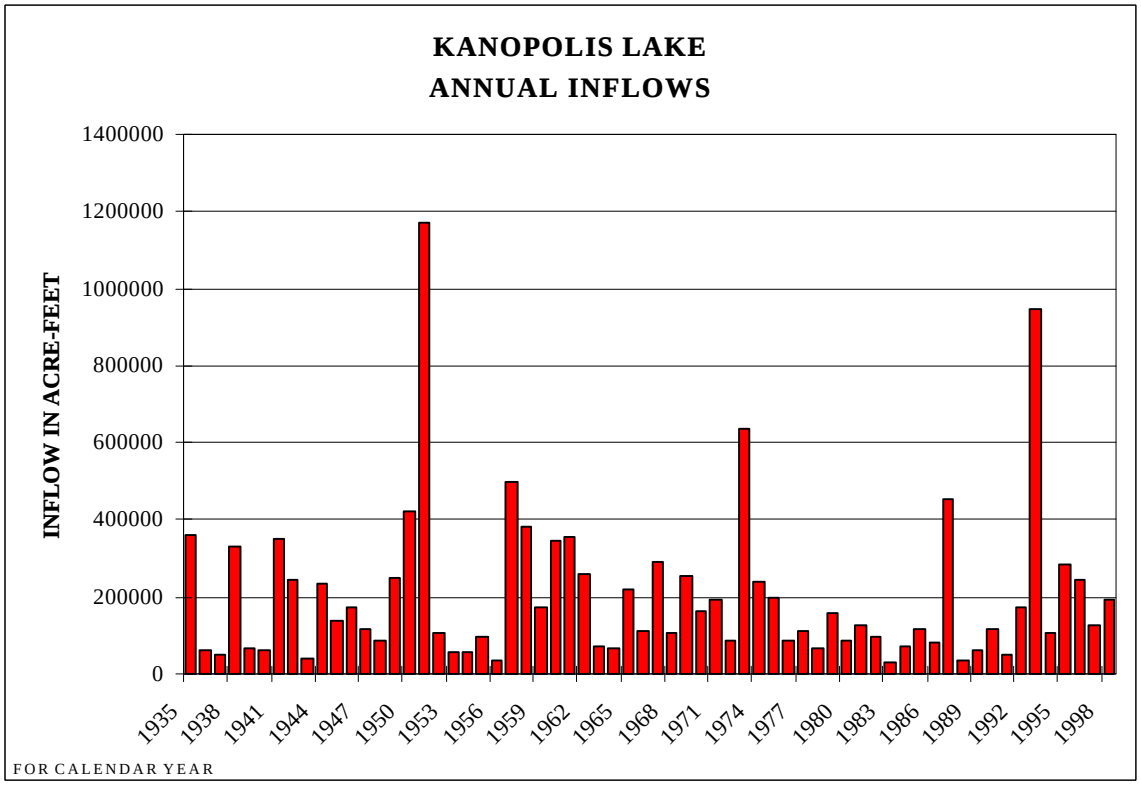


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1466.05 01 Aug 97	**1468.26 31 Jul 98**	**1471.63 11 Apr 98**	**1462.89 03 Mar 98**	**1506.98 14 Jul 51**	**1453.50 20 Sep 88**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
6,070 10 Apr 98	**249,427**	**1,763 11 April 98**	**28 2- 11 Oct 97**

dsf = day-second-feet ac-ft = acre-feet


KANOPOLIS LAKE INFLOWS
1997-98 ANNUAL REPORT
ACRE-FEET
70000
60000
50000
40000
30000
20000
10000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1935-97
HISTORICAL AVERAGE
ACTUAL


KANOPOLIS LAKE
ANNUAL INFLOWS
INFLOW IN ACRE-FEET
1400000
1200000
1000000
800000
600000
400000
200000
0
1935
1938
1941
1944
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1962
1965
1968
1971
1974
1977
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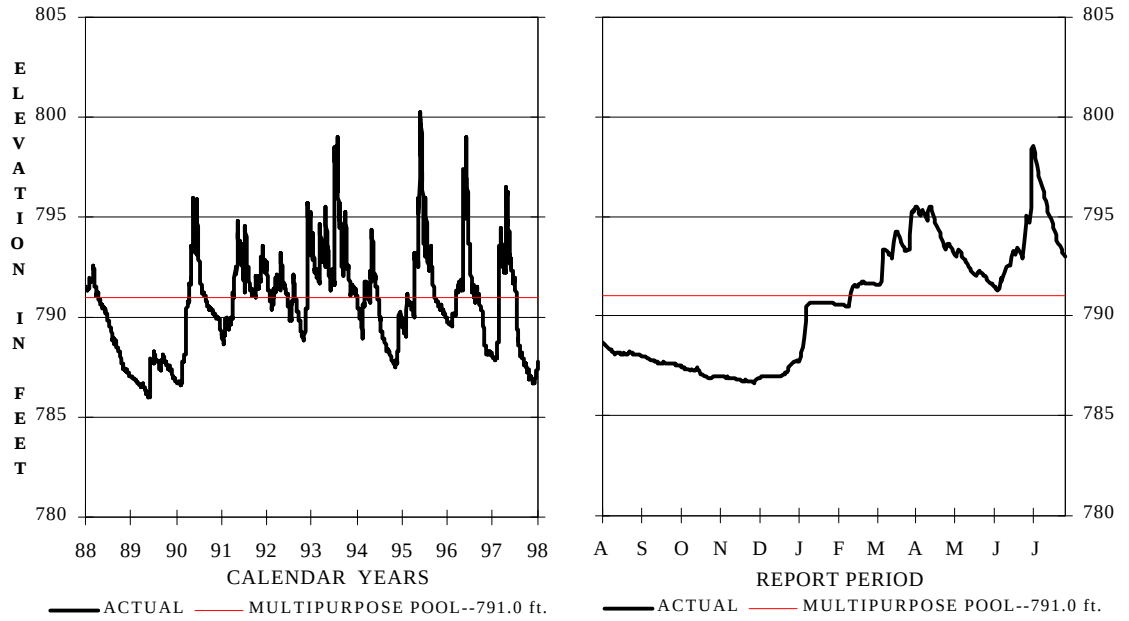
1998
FOR CALENDAR YEAR

LONG BRANCH LAKE
1997-98 REGULATION

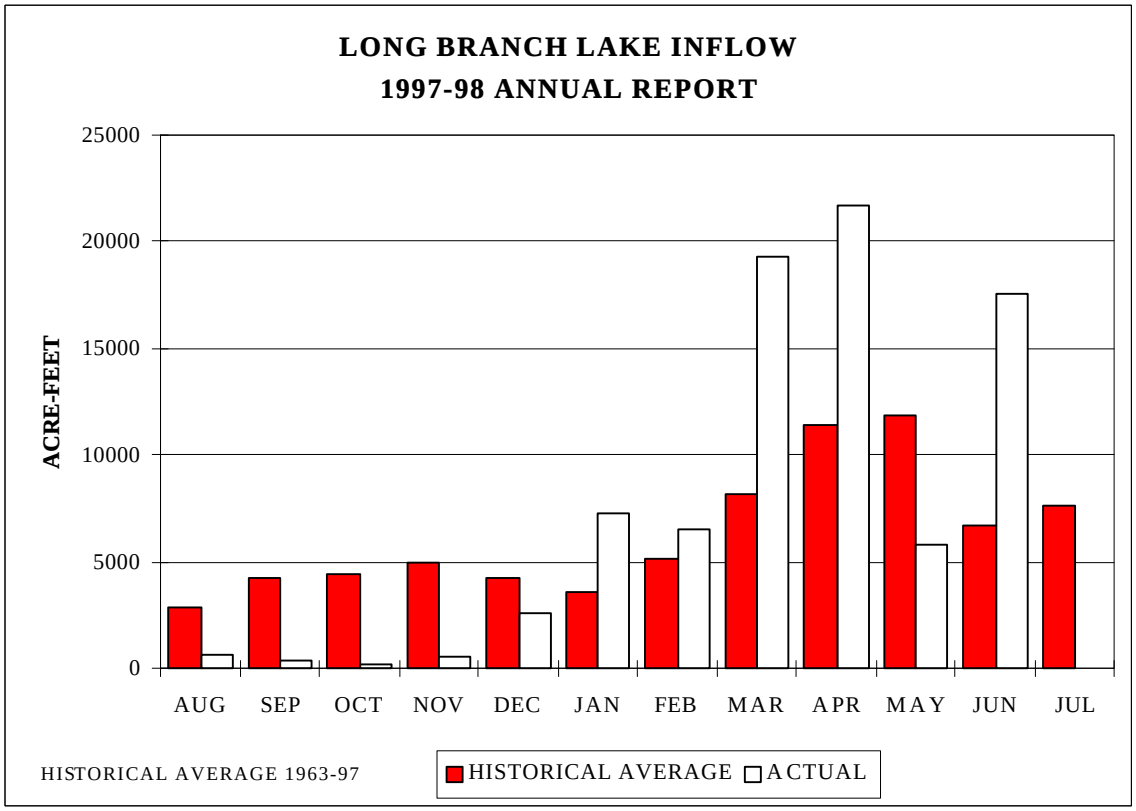
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

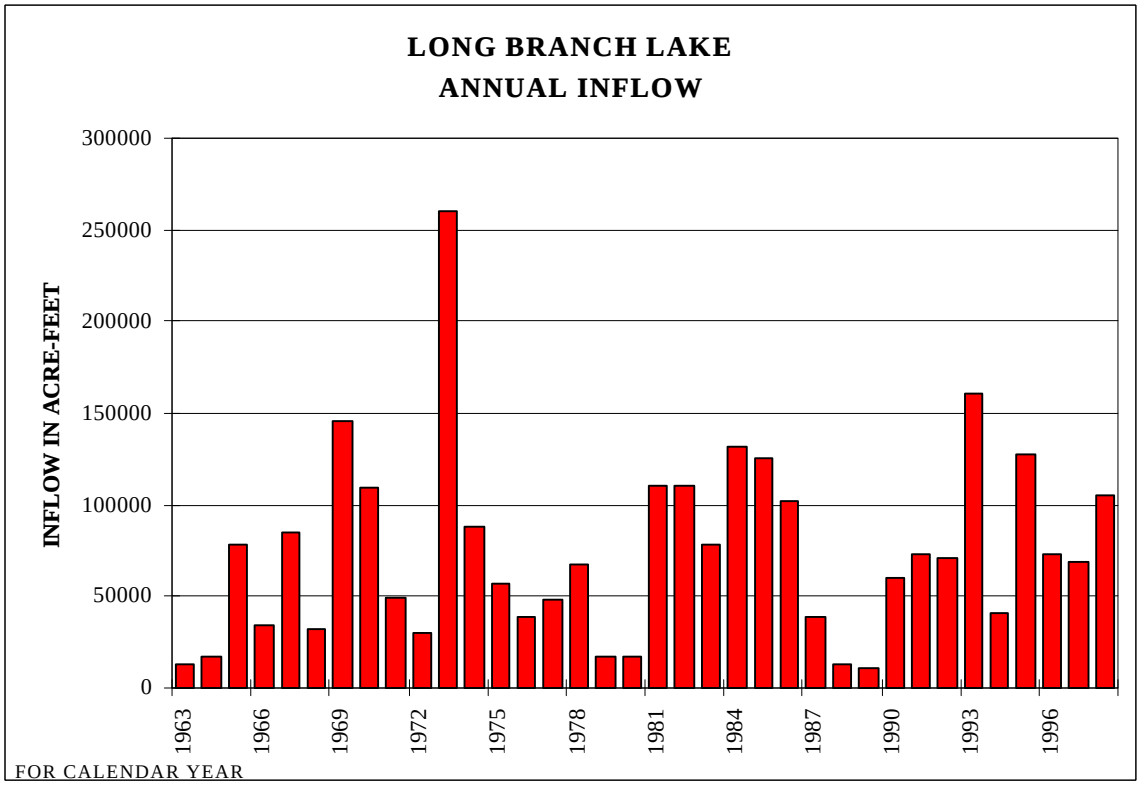


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
788.59 01 Aug 97	**793.01 31 Jul 98**	**798.58 06 Jul 98**	**786.67 27 Nov 97**	**800.25 28 May 95**	**785.95 24 May 89**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
5,230 05 Jul 98	**109,339**	**50 01 Aug 97**	**10 Several Periods**

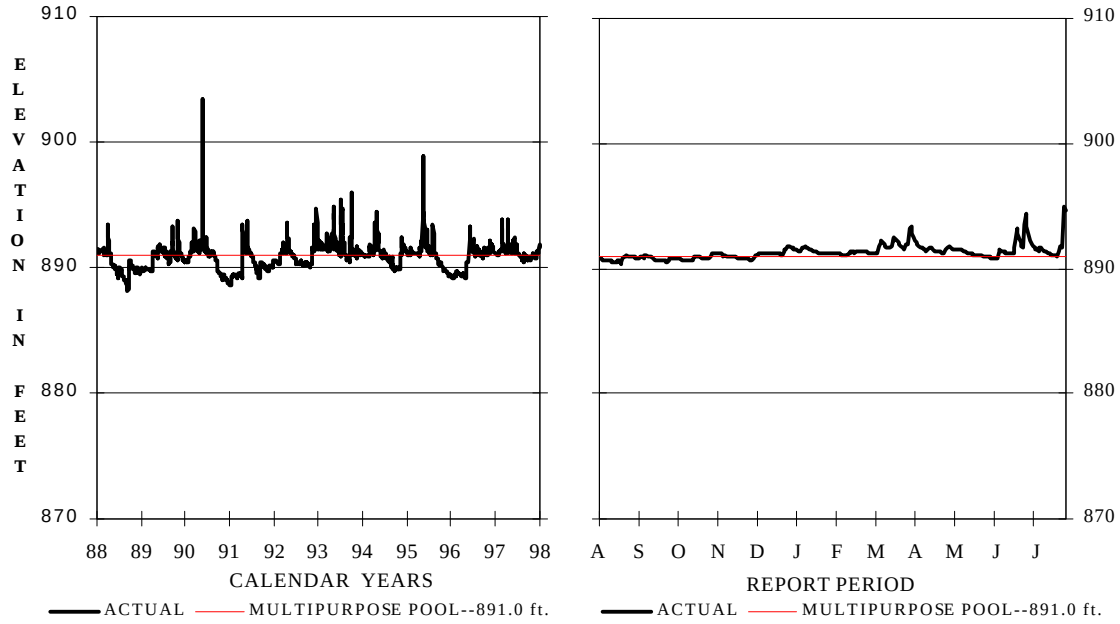
dsf = day-second-feet ac-ft = acre-feet


LONG BRANCH LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
25000
20000
15000
10000
5000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1963-97
HISTORICAL AVERAGE
ACTUAL


LONG BRANCH LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
300000
250000
200000
150000
100000
50000
0
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
FOR CALENDAR YEAR

LONGVIEW LAKE
1997-98 REGULATION

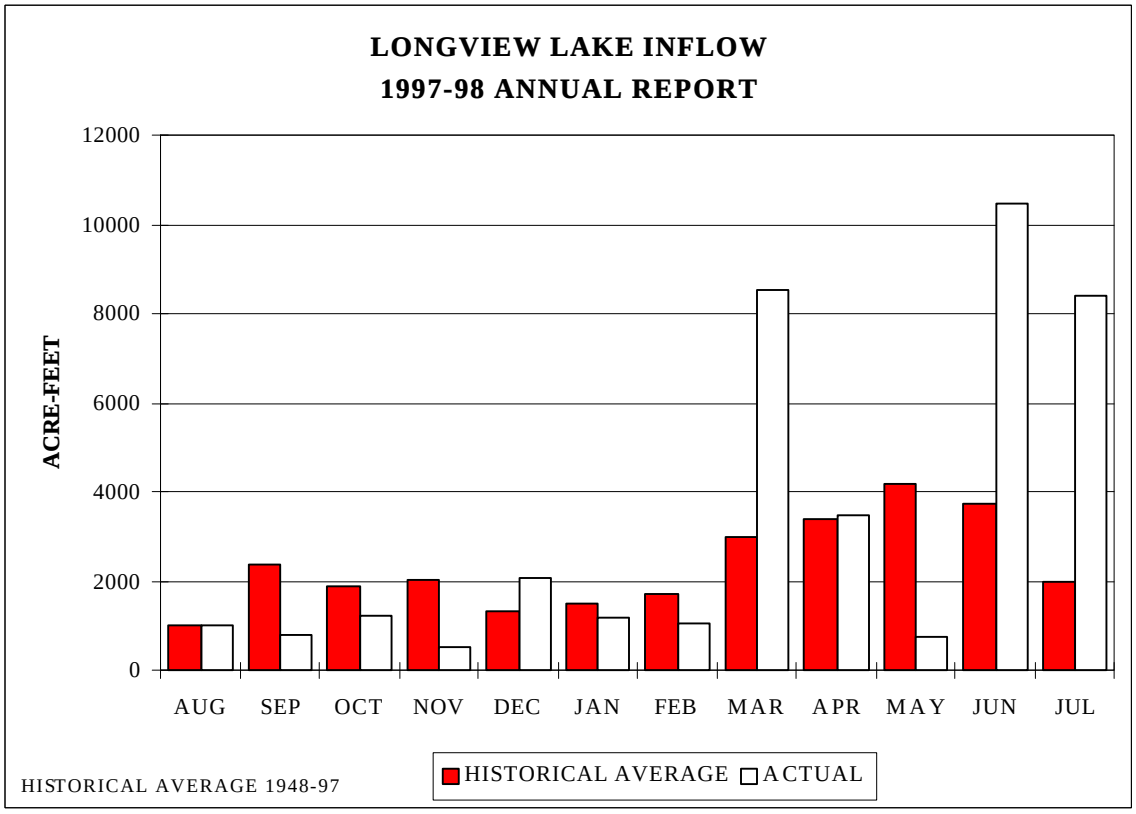
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

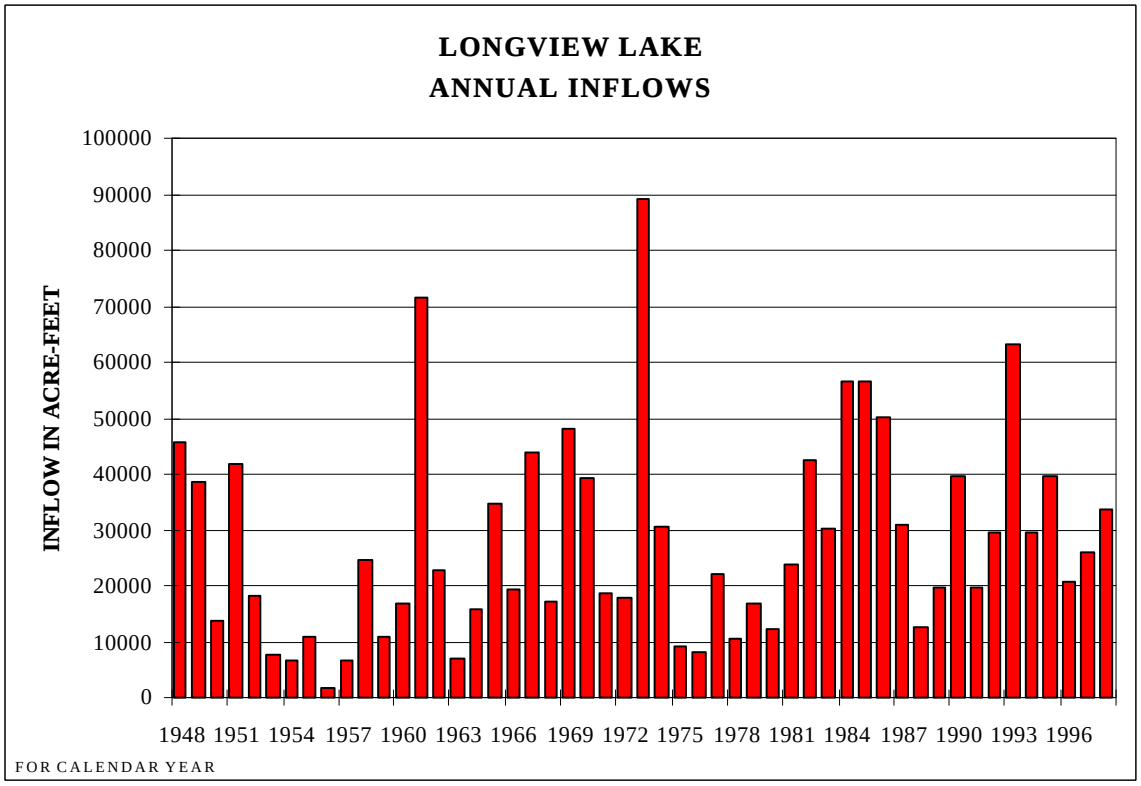


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
890.72 01 Aug 97	**894.72 31 Jul 98**	**894.88 30 Jul 98**	**890.41 16 Aug 97**	**903.40 16 May 90**	**888.1 14 Sep 88**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
2,690 30 Jul 98	**39,451**	**10 23 Jun 98**	**0 2 Sep 97**

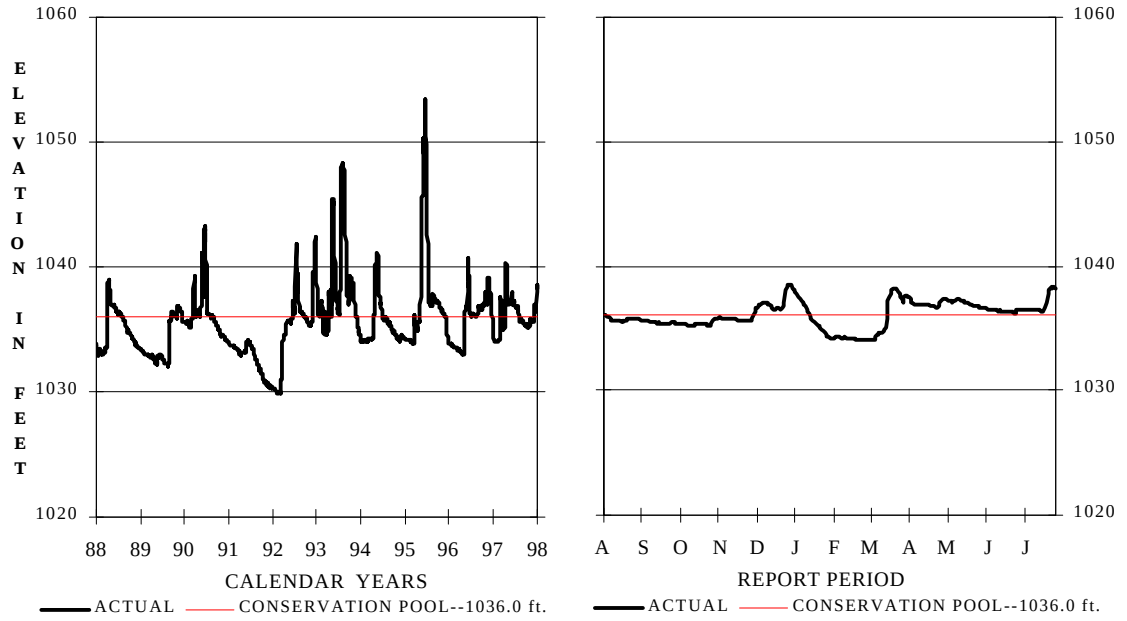
dsf = day-second-feet ac-ft = acre-feet


LONGVIEW LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
12000
10000
8000
6000
4000
2000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1948-97
HISTORICAL AVERAGE
ACTUAL


LONGVIEW LAKE
ANNUAL INFLOWS
INFLOW IN ACRE-FEET
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1948 1951 1954 1957 1960 1963 1966 1969 1972 1975 1978 1981 1984 1987 1990 1993 1996
FOR CALENDAR YEAR

MELVERN LAKE
1997-98 REGULATION

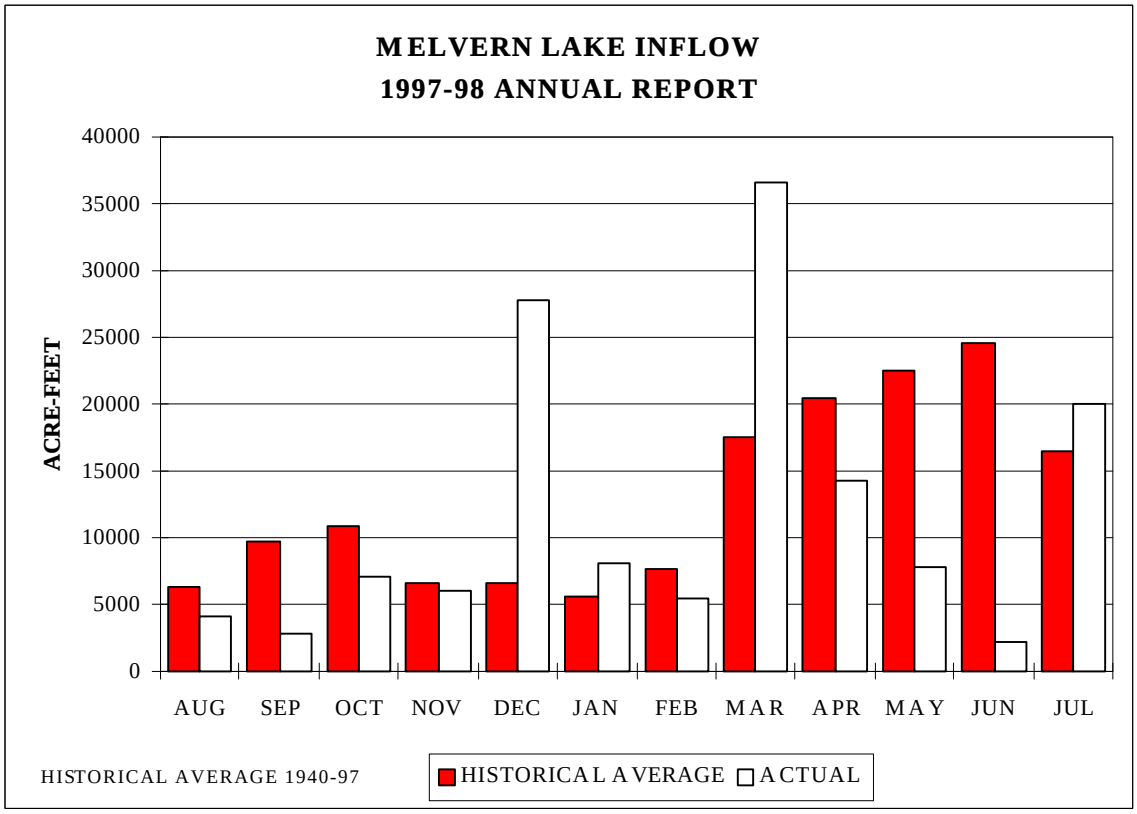
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1036.04 01 Aug 97	**1038.22 31 Jul 98**	**1038.55 29 Dec 97**	**1034.01 23 Feb 98**	**1053.45 13 Jun 95**	**1029.90 11 Feb 92**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
5,250 18 Mar 98	**141,943**	**1,000 27 Mar 98**	**20 Several Periods**

dsf = day-second-feet ac-ft = acre-feet


MELVERN LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
40000
35000
30000
25000
20000
15000
10000
5000
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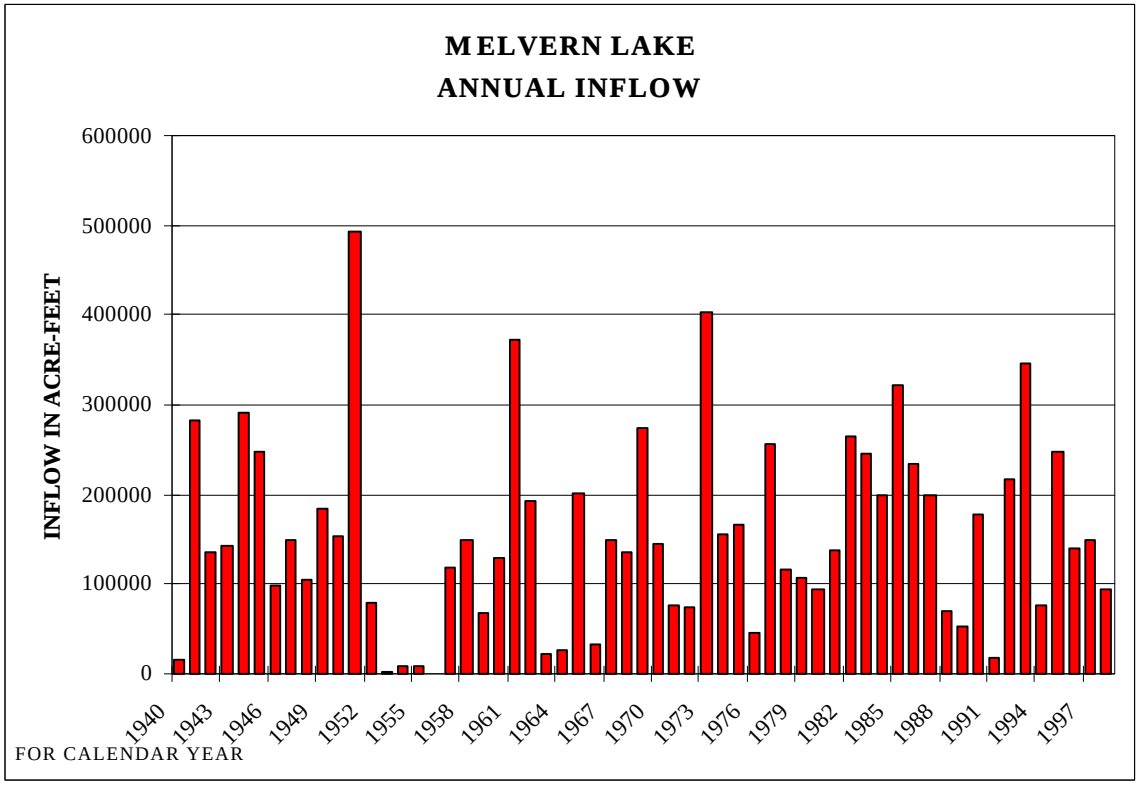
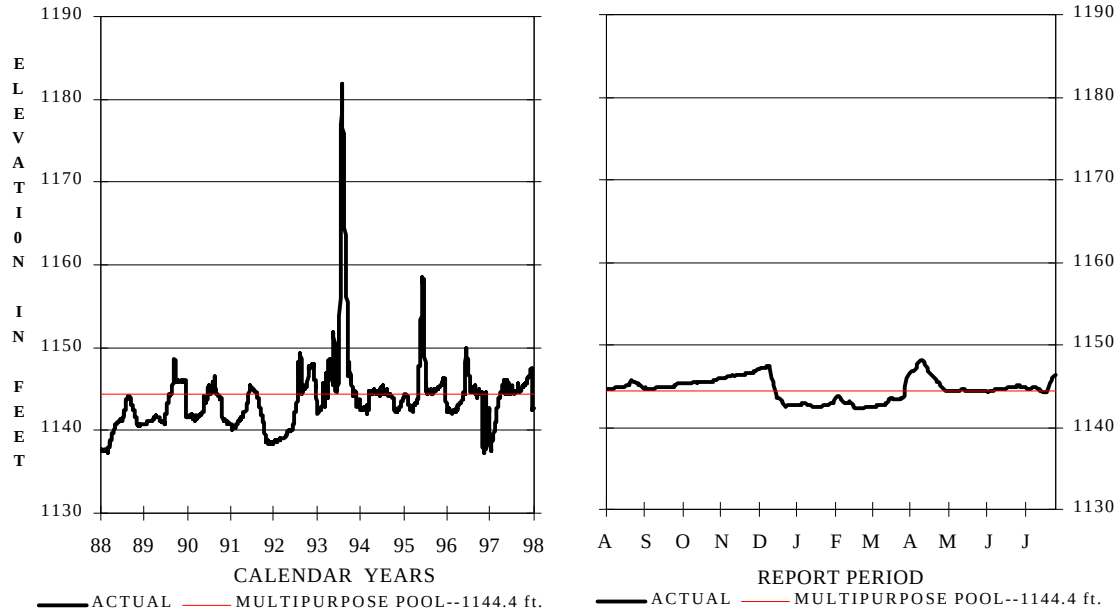
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1940-97
HISTORICAL AVERAGE
ACTUAL


MELVERN LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
600000
500000
400000
300000
200000
100000
0
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
FOR CALENDAR YEAR

MILFORD LAKE
1997-98 REGULATION

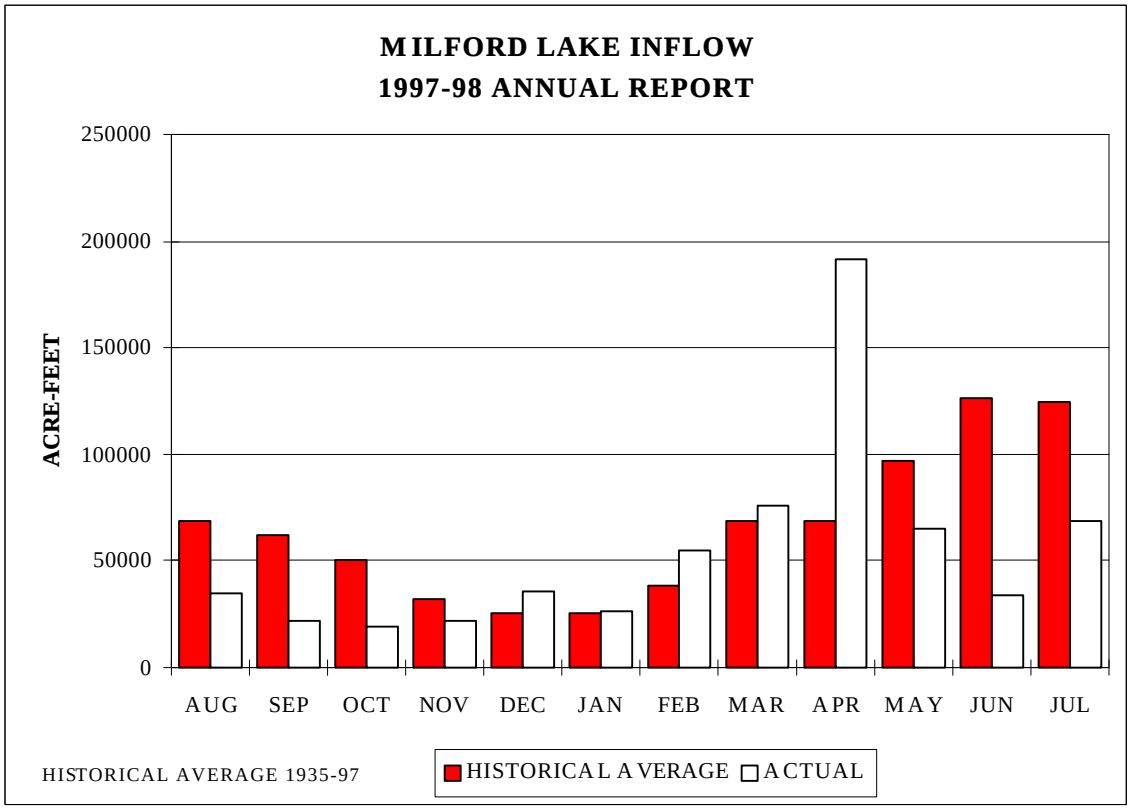
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

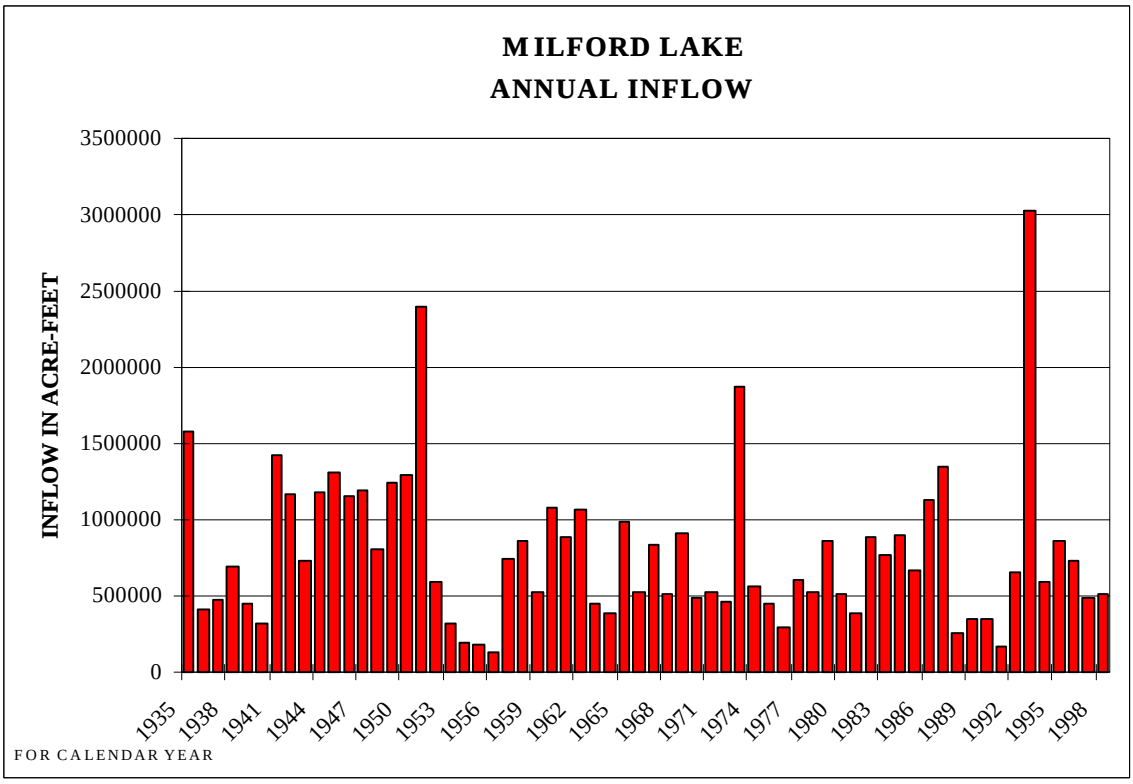


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1144.58 **01 Aug 97**	**1146.35** **31 Jul 98**	**1148.15** **13 Apr 98**	**1142.27** **19 Feb 98**	**1181.9** **25 Jul 93**	**1137.30** **21Oct - 26Feb 88**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
11,100 **01 Apr 98**	**649,146**	**11,230** **12 Dec 97**	**0** **Most of the Winter**

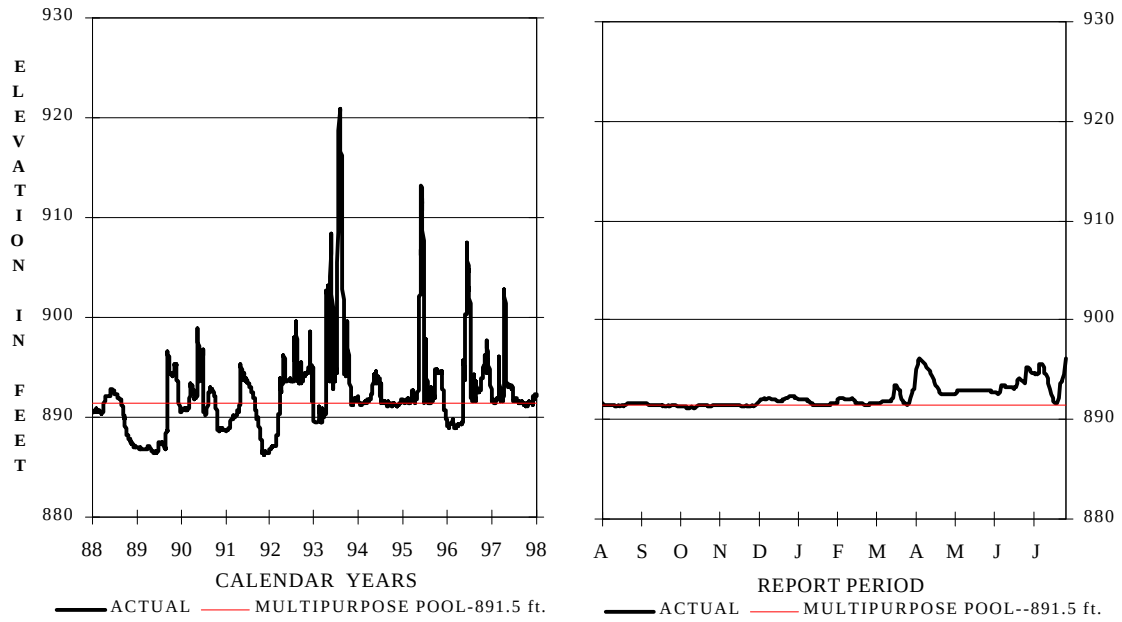
dsf = day-second-feet ac-ft = acre-feet


MILFORD LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
250000
200000
150000
100000
50000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1935-97
HISTORICAL AVERAGE
ACTUAL


MILFORD LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
FOR CALENDAR YEAR

PERRY LAKE
1997-98 REGULATION

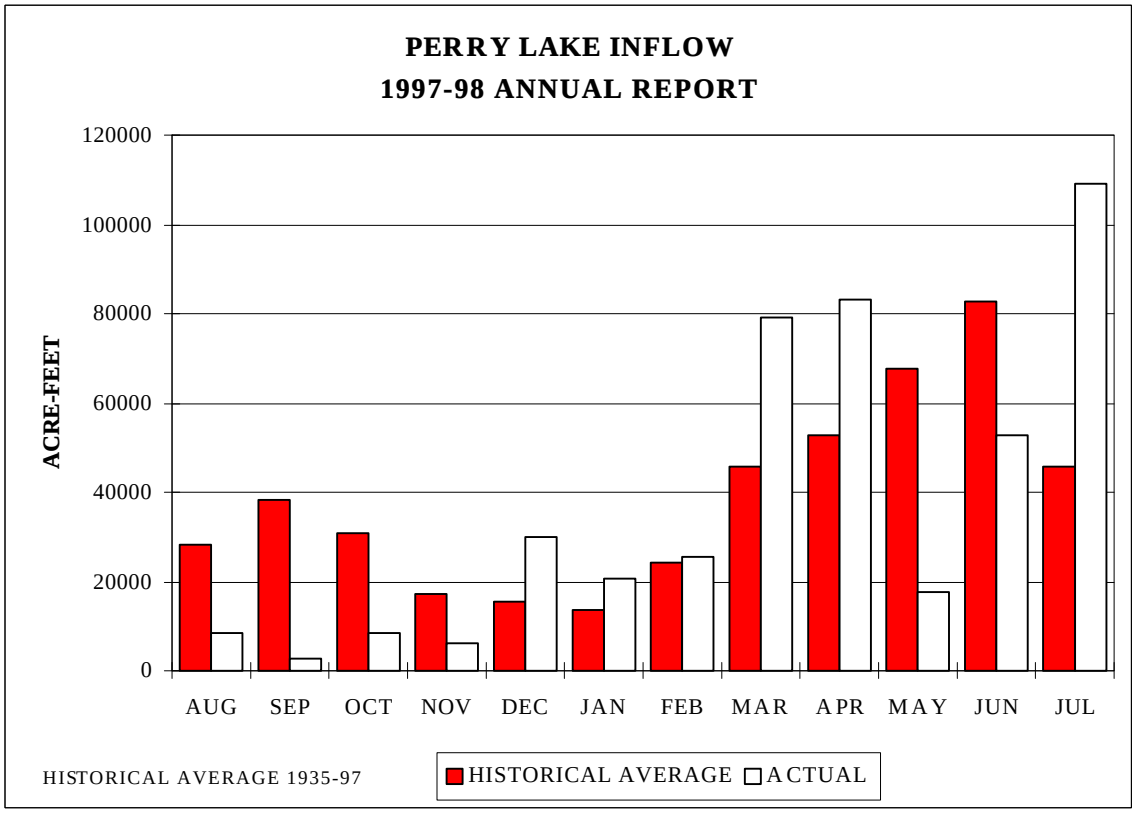
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

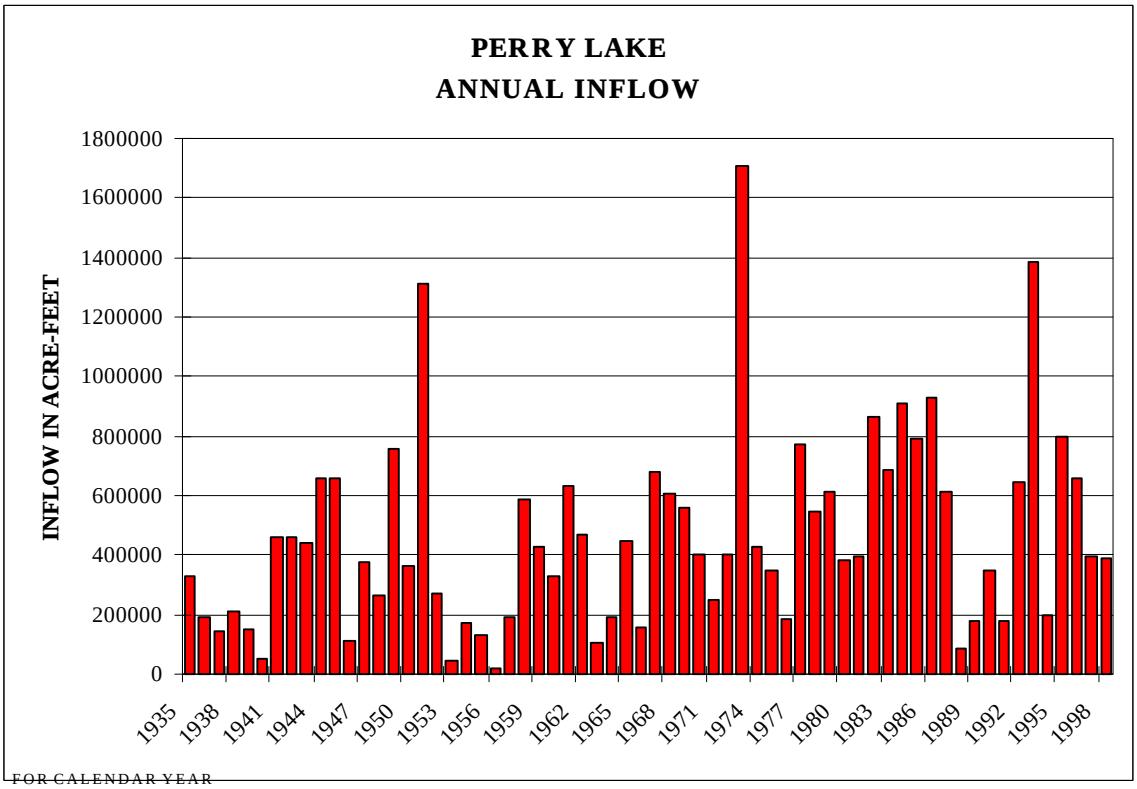


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
891.53 01 Aug 97	**896.09 31 Jul 98**	**896.09 31 Jul 98**	**891.10 08 Oct 97**	**920.9 25 Jul 93**	**886.3 14 Nov 91**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
12,200 04 Apr 98	**442,805**	**3,500 20 - 24 Mar 98**	**0 Several Days**

dsf = day-second-feet ac-ft = acre-feet


PERRY LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
120000
100000
80000
60000
40000
20000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1935-97
HISTORICAL AVERAGE
ACTUAL


PERRY LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
1935
1938
1941
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1968
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1986
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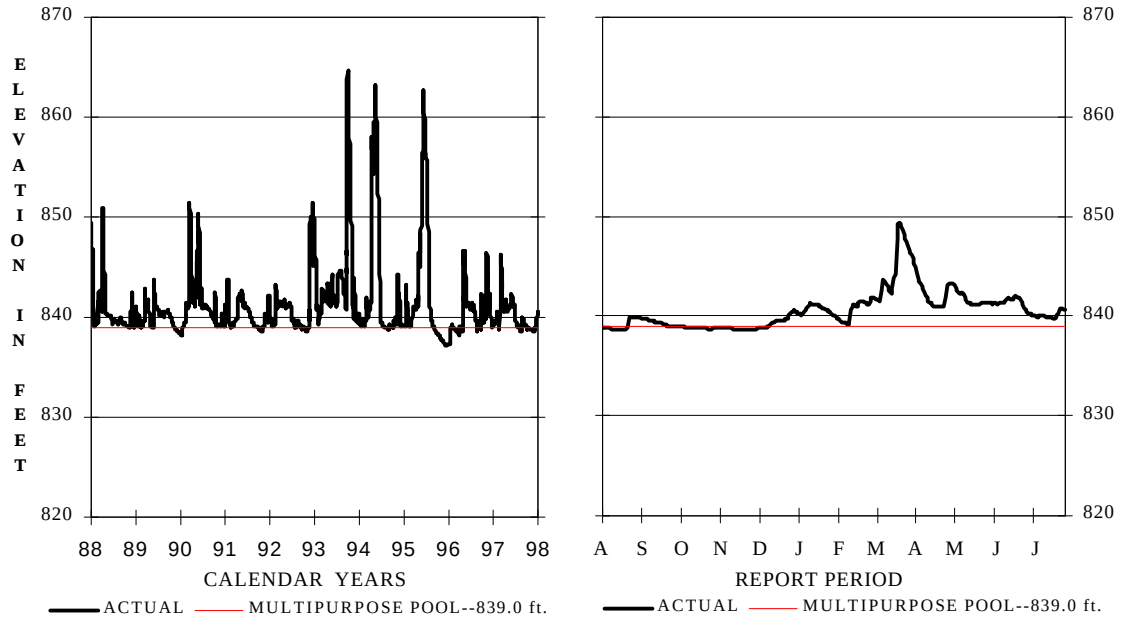
1992
1995
1998
FOR CALENDAR YEAR

POMME DE TERRE LAKE
1997-98 REGULATION

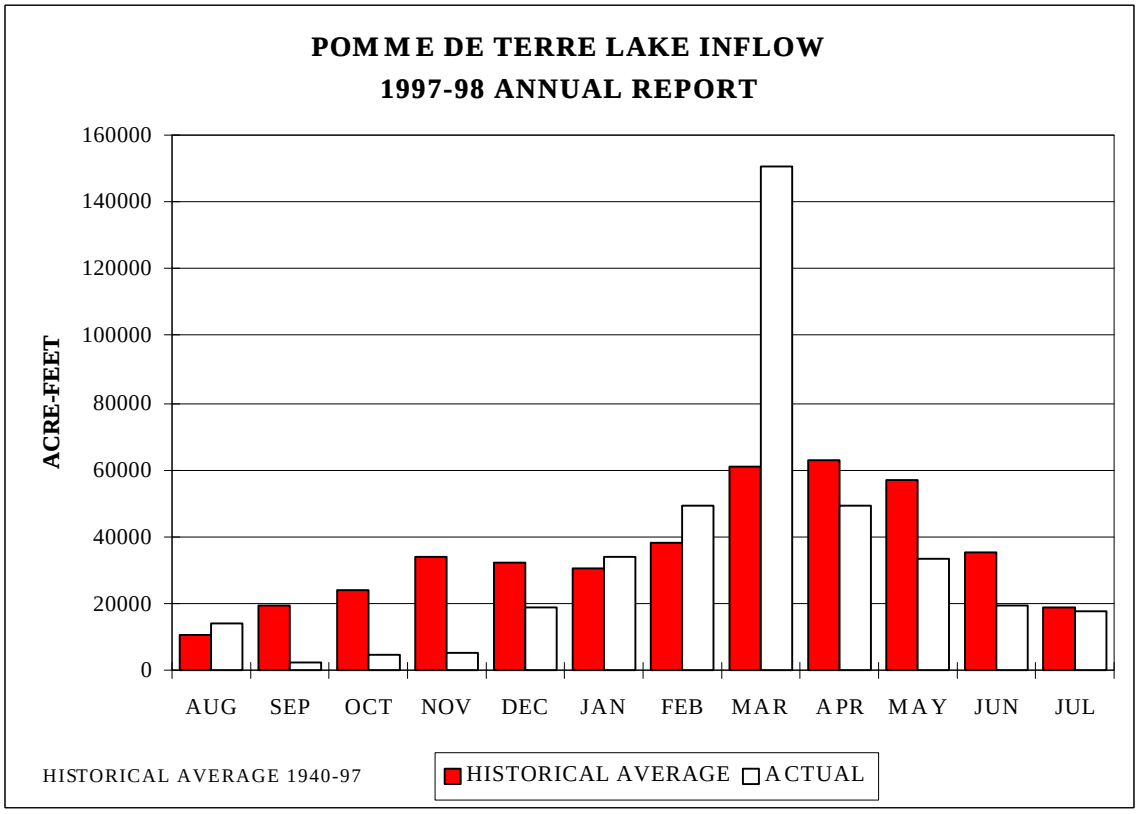
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

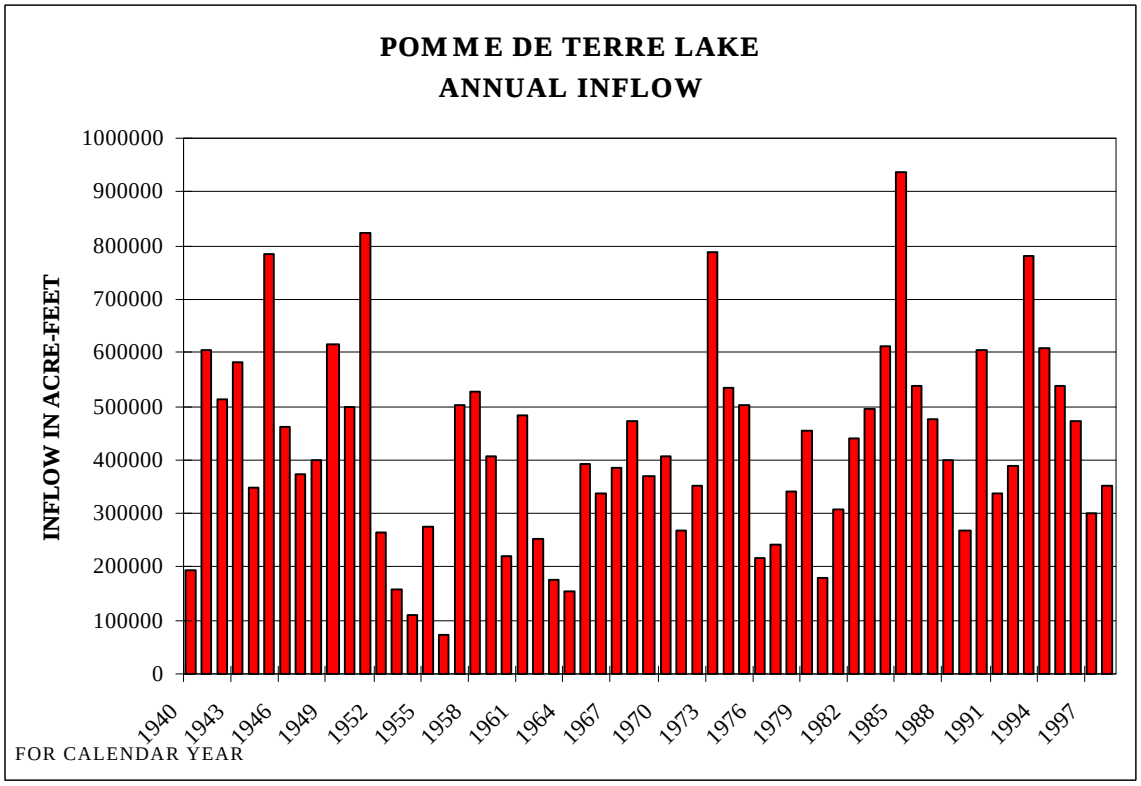


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
838.84 01 Aug 97	**840.68 31 Jul 98**	**849.34 22 Mar 98**	**838.55 16 Aug 97**	**864.58 27 Sep 93**	**835.61 03 Mar 64**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
17,730 20 Mar 98	**398,852**	**3,000 06 Apr 98**	**50 Several Days**

dsf = day-second-feet ac-ft = acre-feet


POMME DE TERRE LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
160000
140000
120000
100000
80000
60000
40000
20000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1940-97
HISTORICAL AVERAGE
ACTUAL


POMME DE TERRE LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
1940
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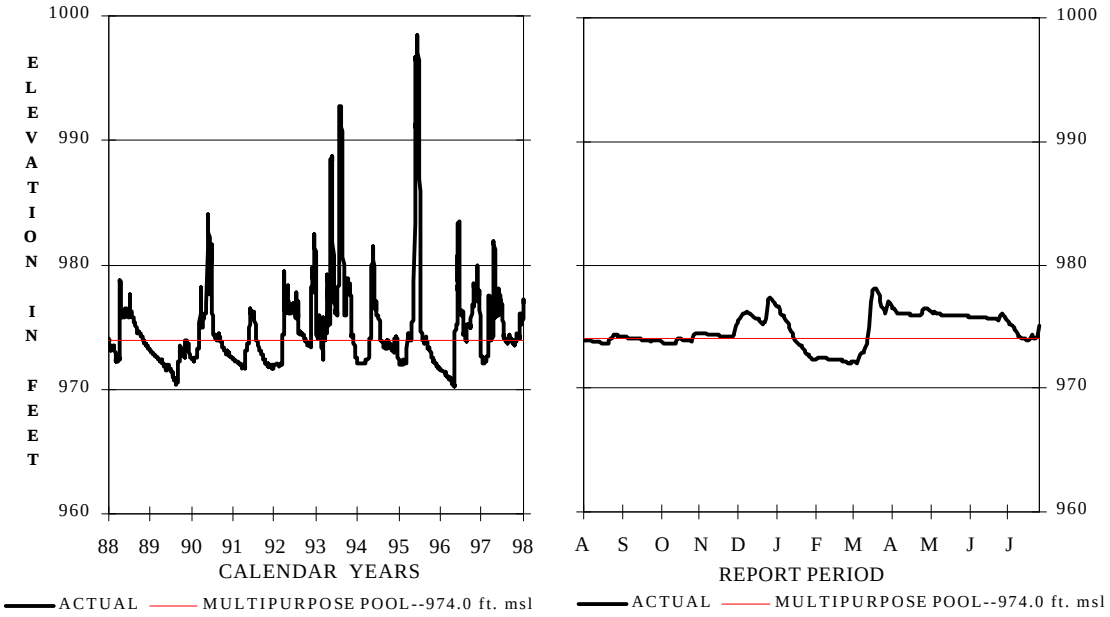
1997
FOR CALENDAR YEAR

POMONA LAKE
1997-98 REGULATION

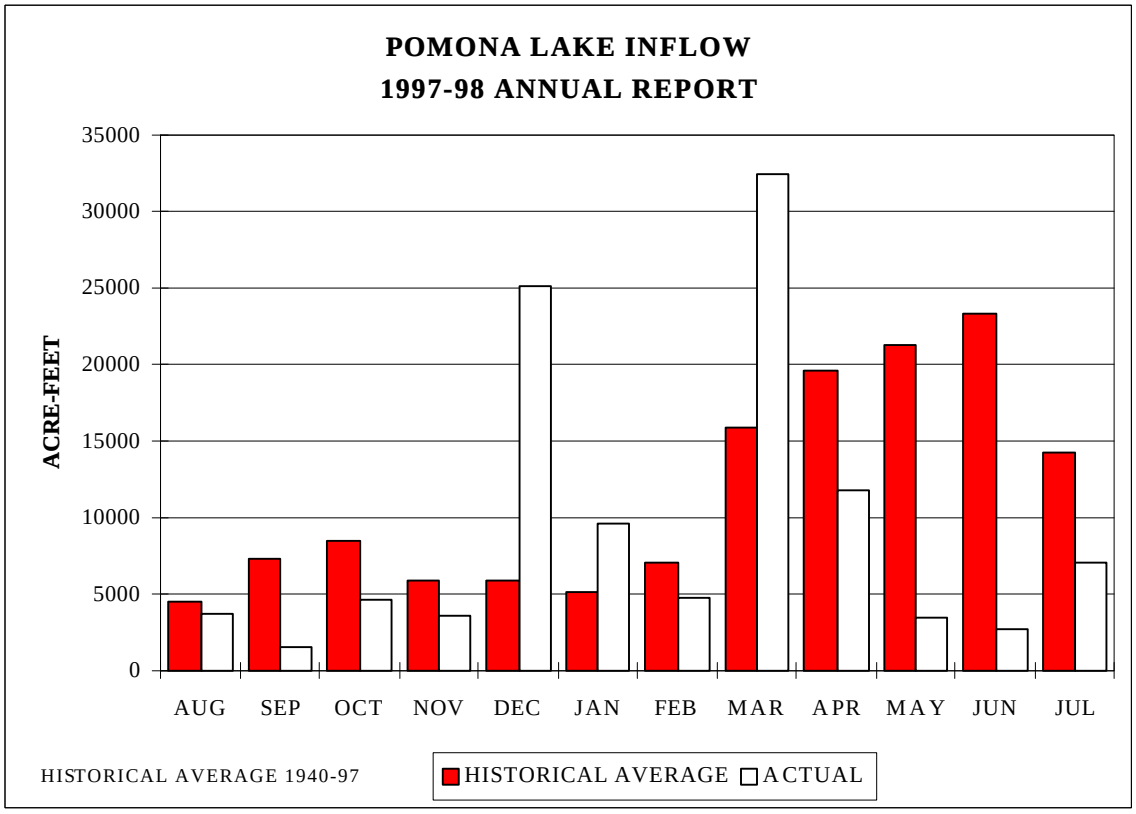
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

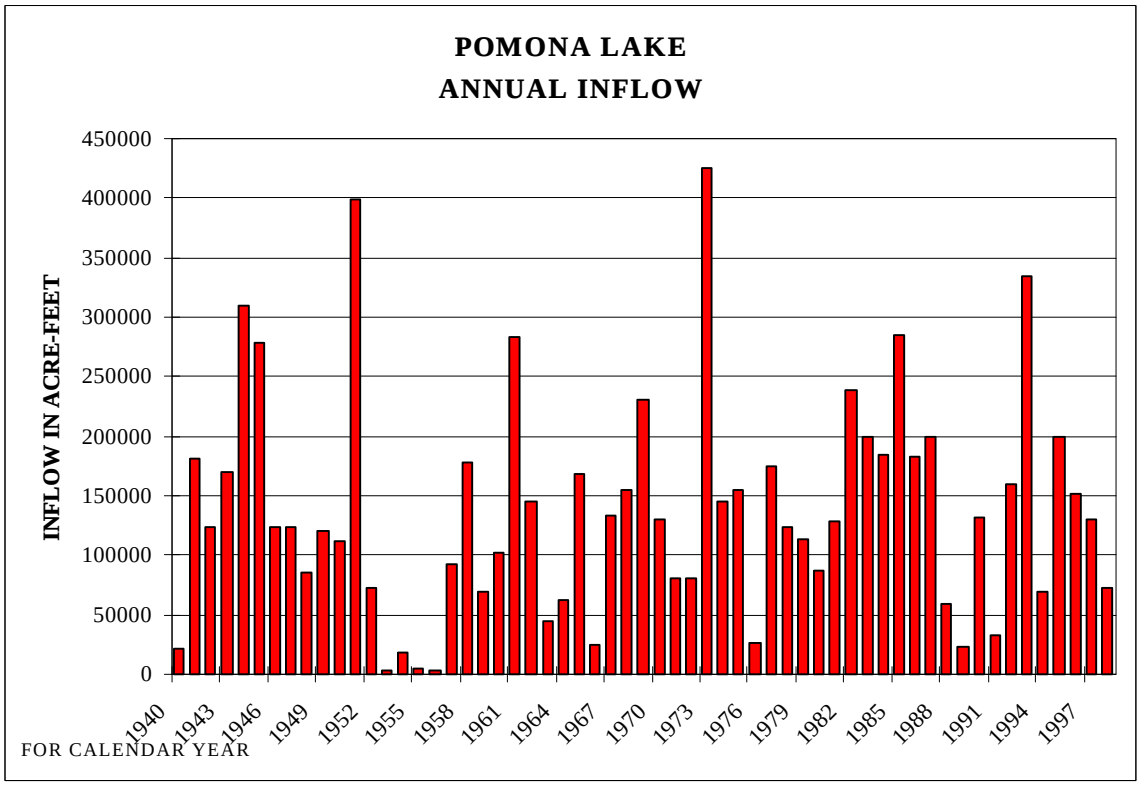


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
973.94 01 Aug 97	**974.99 31 Jul 98**	**978.11 22 Mar 98**	**972.07 28 Feb 98**	**998.40 13 Jun 95**	**969.60 29-30 Mar 67**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
4,820 18 Mar 98	**110,145**	**1,000 26 Mar 98**	**10 Various Periods**

dsf = day-second-feet ac-ft = acre-feet


POMONA LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
35000
30000
25000
20000
15000
10000
5000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1940-97
HISTORICAL AVERAGE
ACTUAL


POMONA LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
1940
1943
1946
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1958
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1964
1967
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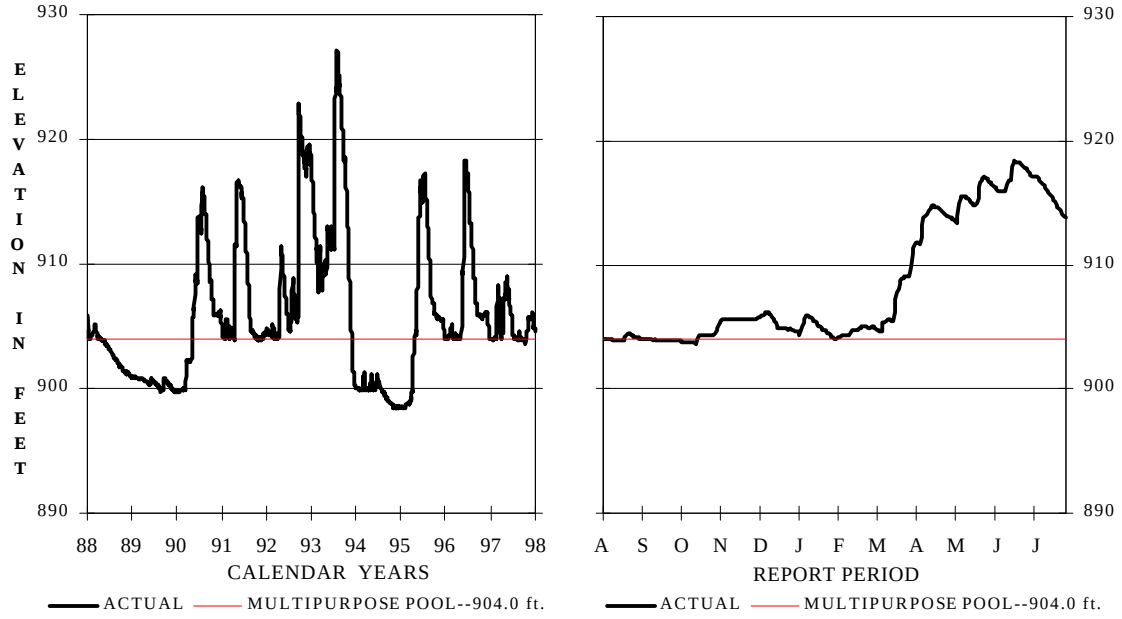
1982
1985
1988
1991
1994
1997
FOR CALENDAR YEAR

RATHBUN LAKE
1997-98 REGULATION

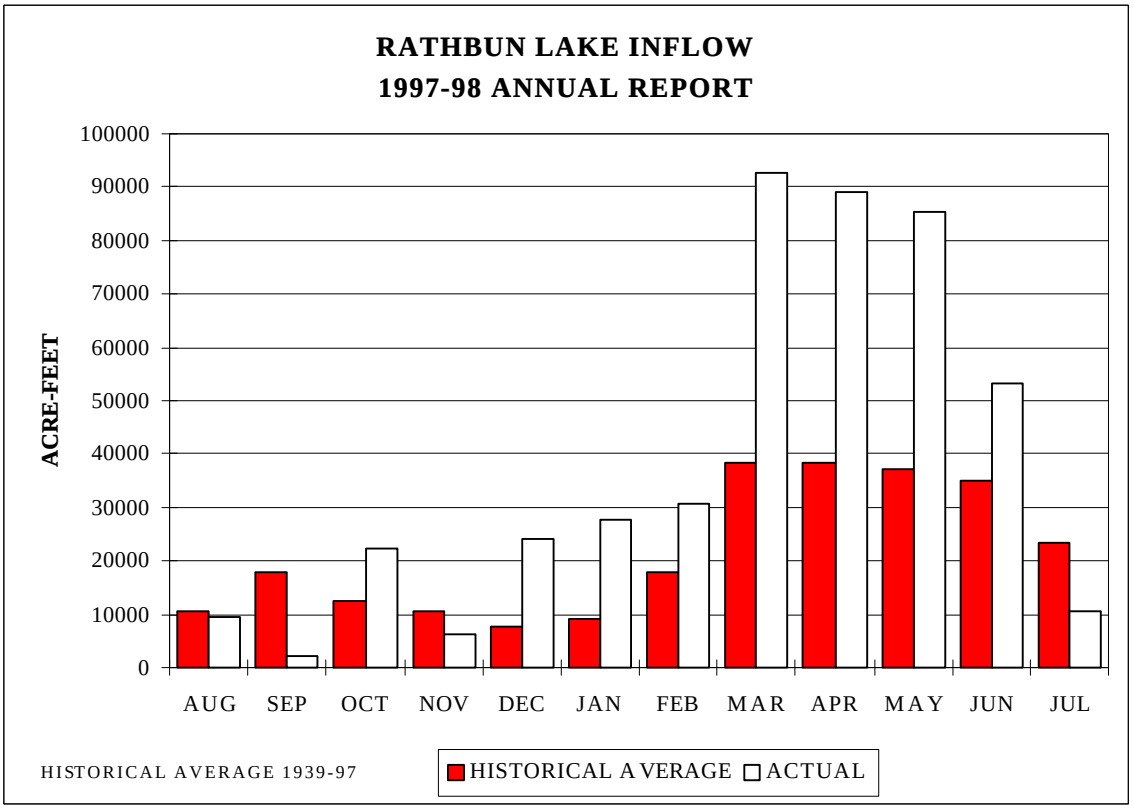
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

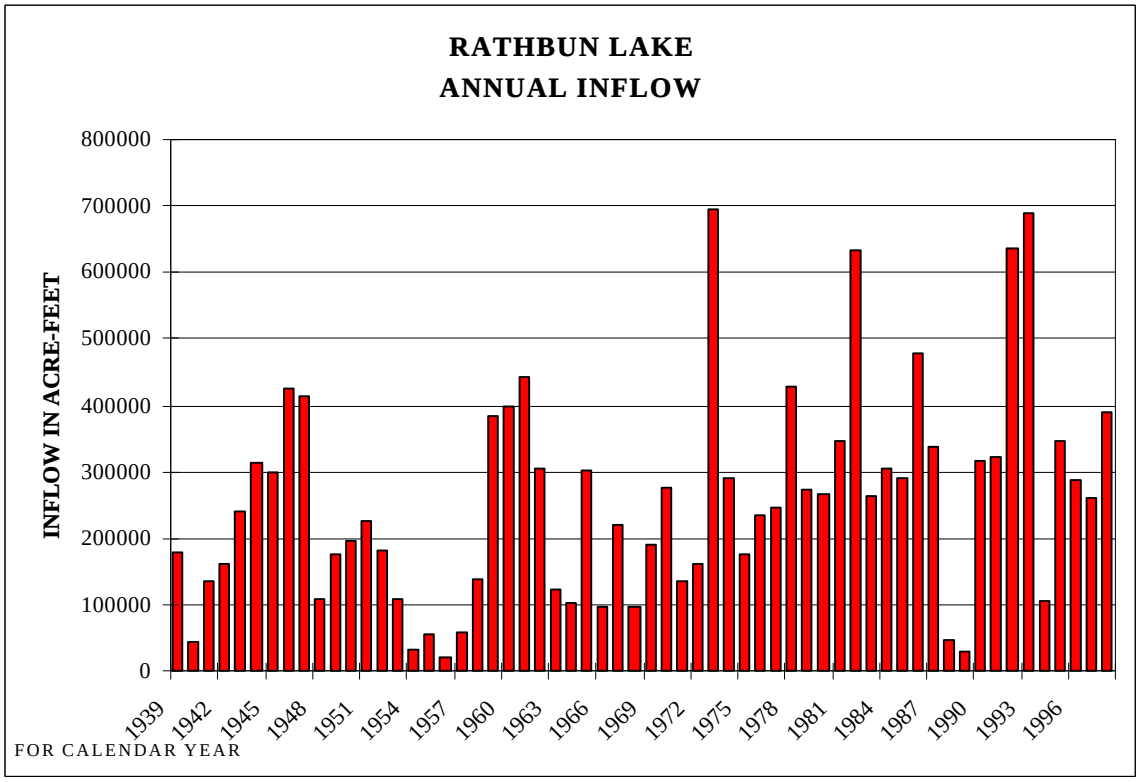


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
904.08 01 Aug 97	**903.75 31 Jul 98**	**918.32 21 Jun 98**	**903.63 12 Oct 97**	**927.17 28 Jul 93**	**898.39 26 Jan 95**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
9,580 19 Jun 98	**453,870**	**1,200 11-15 Dec 97**	**10 Most of the Year**

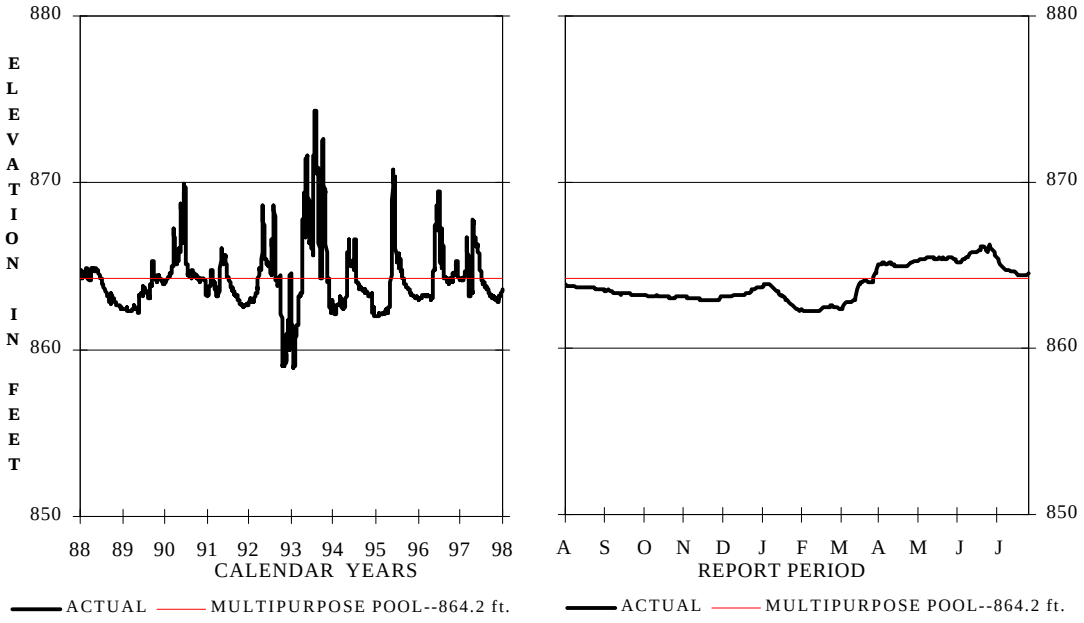
dsf = day-second-feet ac-ft = acre-feet


RATHBUN LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1939-97
HISTORICAL AVERAGE
ACTUAL


RATHBUN LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
800000
700000
600000
500000
400000
300000
200000
100000
0
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
FOR CALENDAR YEAR

SMITHVILLE LAKE
1997-98 REGULATION

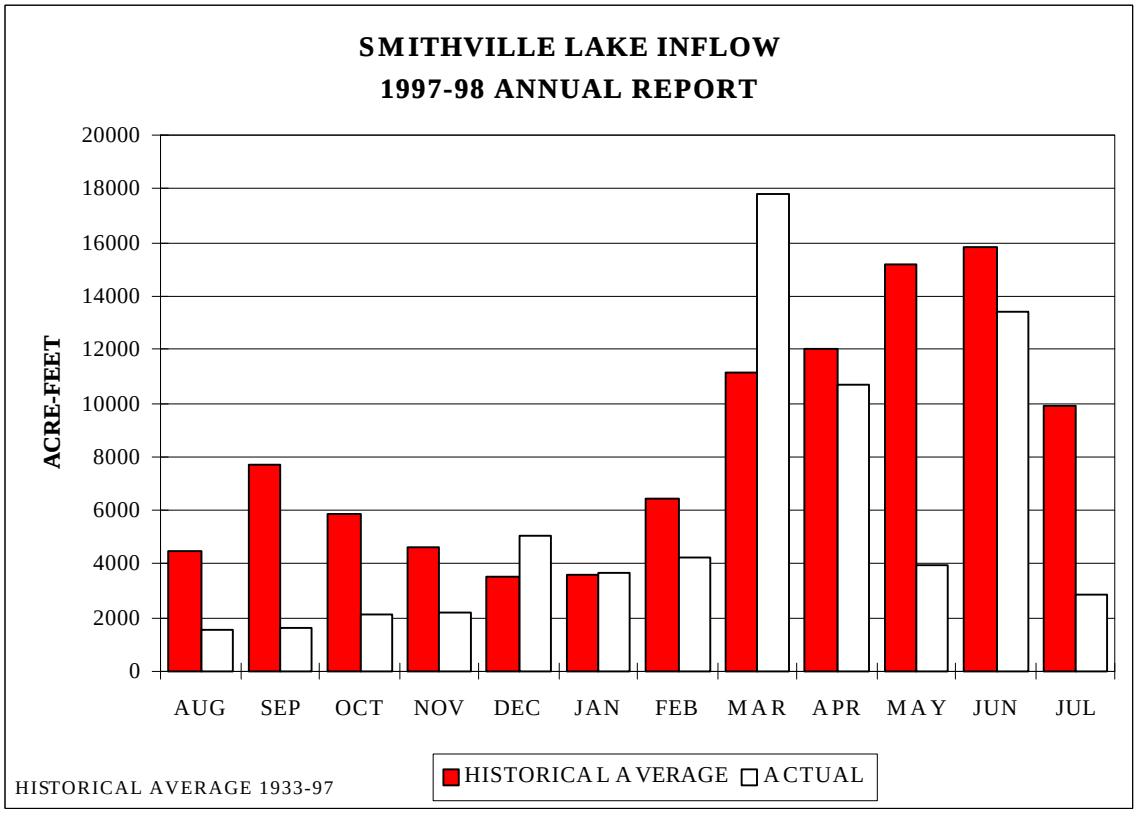
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

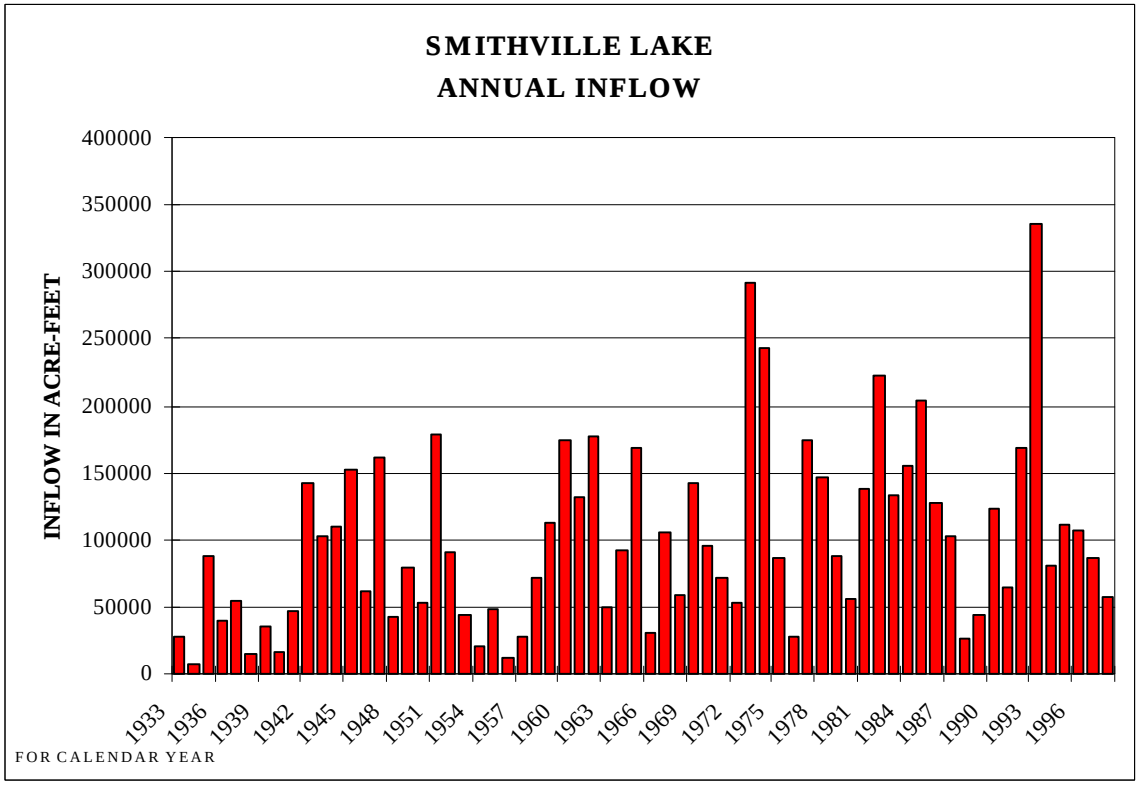


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
863.81 01 Aug 97	**864.49 31 Jul 98**	**866.24 30 Jun 98**	**862.23 09 Feb 98**	**874.31 28 Jul 93**	**858.87 19 Jan 93**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
1,900 30 Jun 98	**69,079**	**500 Several Days**	**0 Several Days**

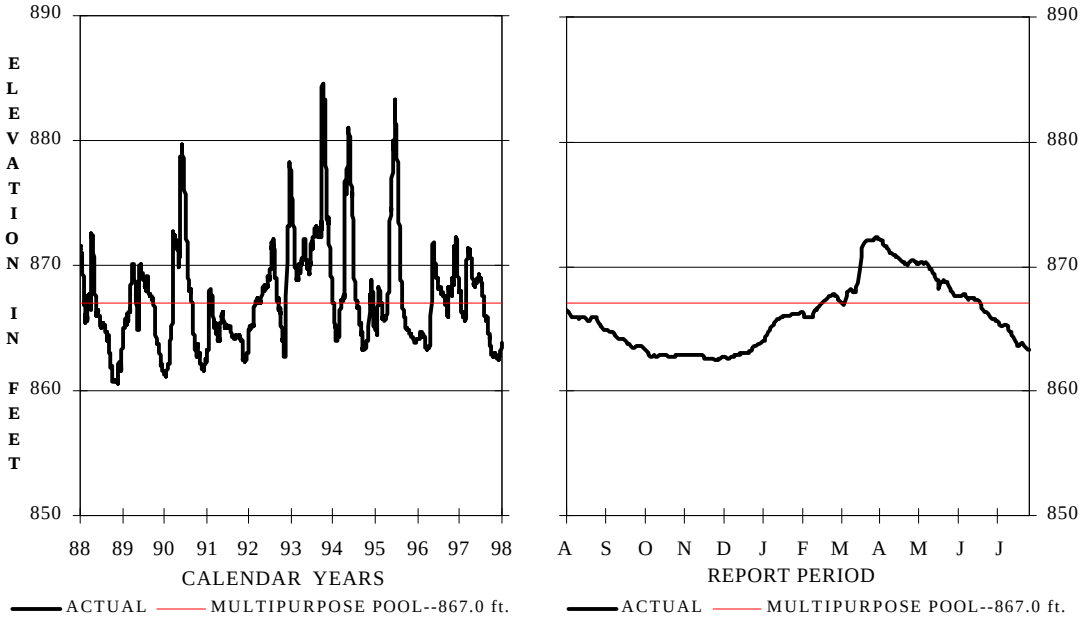
dsf = day-second-feet ac-ft = acre-feet


SMITHVILLE LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE
ACTUAL
HISTORICAL AVERAGE 1933-97


SMITHVILLE LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
400000
350000
300000
250000
200000
150000
100000
50000
0
1933
1936
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
FOR CALENDAR YEAR

STOCKTON LAKE
1997-98 REGULATION

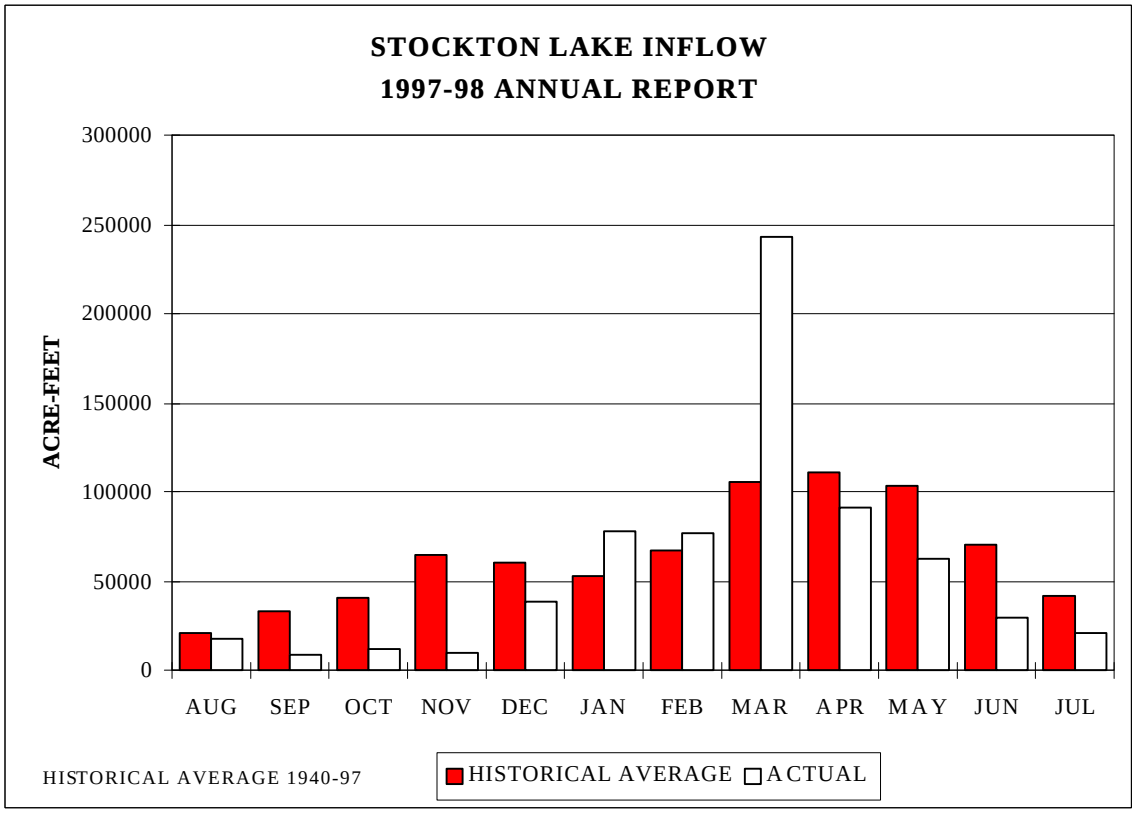
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

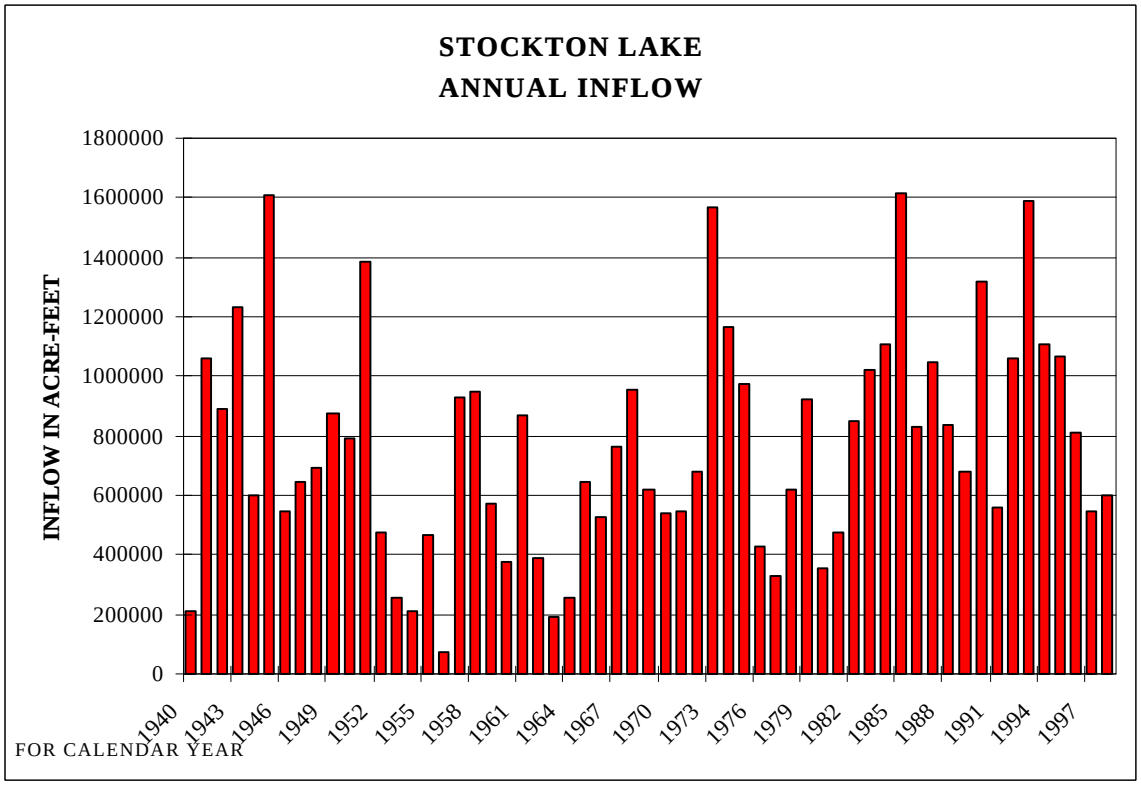


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
866.37 01 Aug 97	**863.35 31 Jul 98**	**872.32 02 Apr 98**	**862.49 26 Nov 97**	**885.94 28 Apr 73**	**851.86 07 Feb 77**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Low Flow dsf.
16,335 20 Mar 98	**687,843**	**2,000 Several Days**	**13 19 May 98**

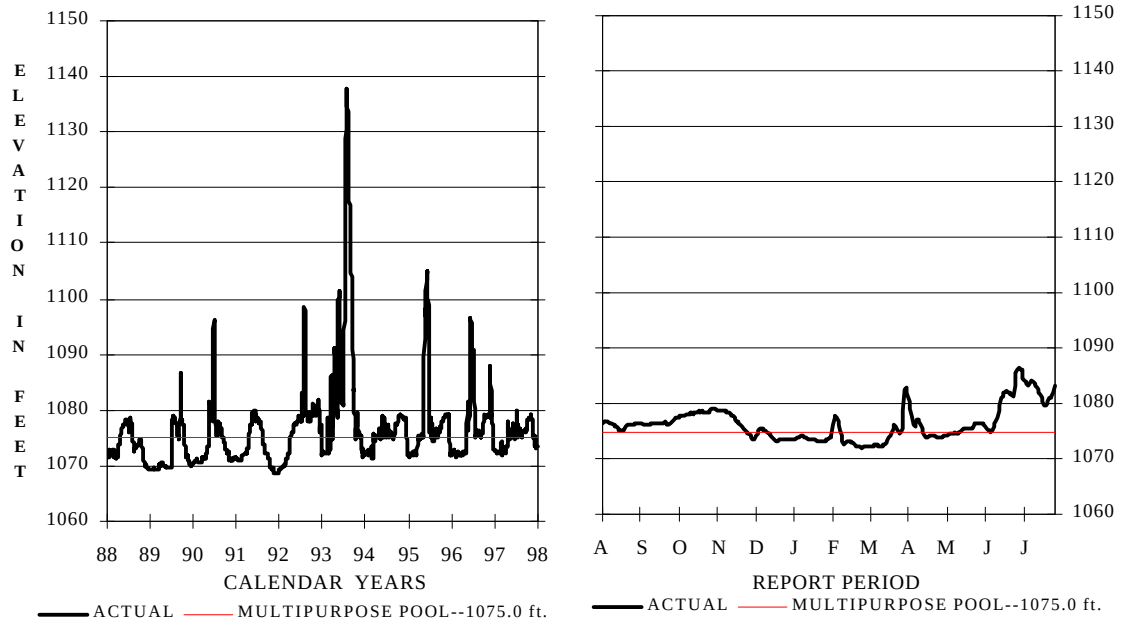
dsf = day-second-feet ac-ft = acre-feet


STOCKTON LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
300000
250000
200000
150000
100000
50000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1940-97
HISTORICAL AVERAGE
ACTUAL


STOCKTON LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
FOR CALENDAR YEAR

TUTTLE CREEK LAKE
1997-98 REGULATION

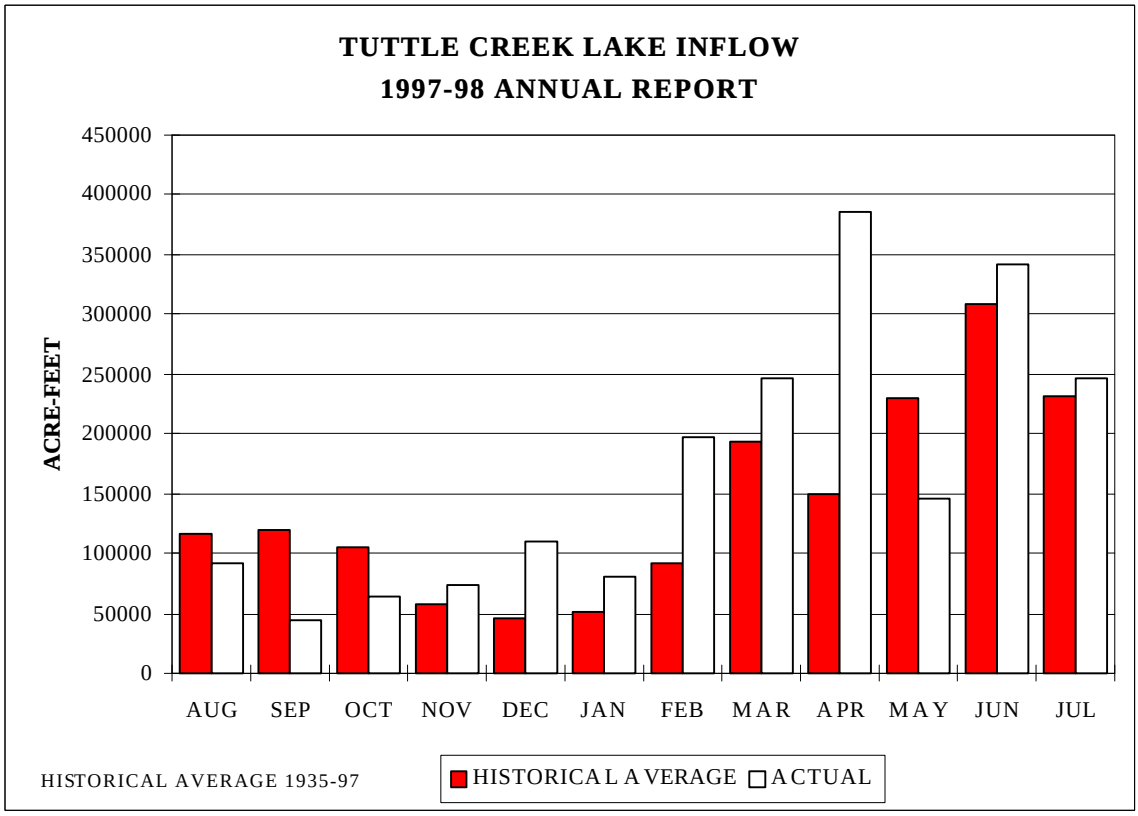
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

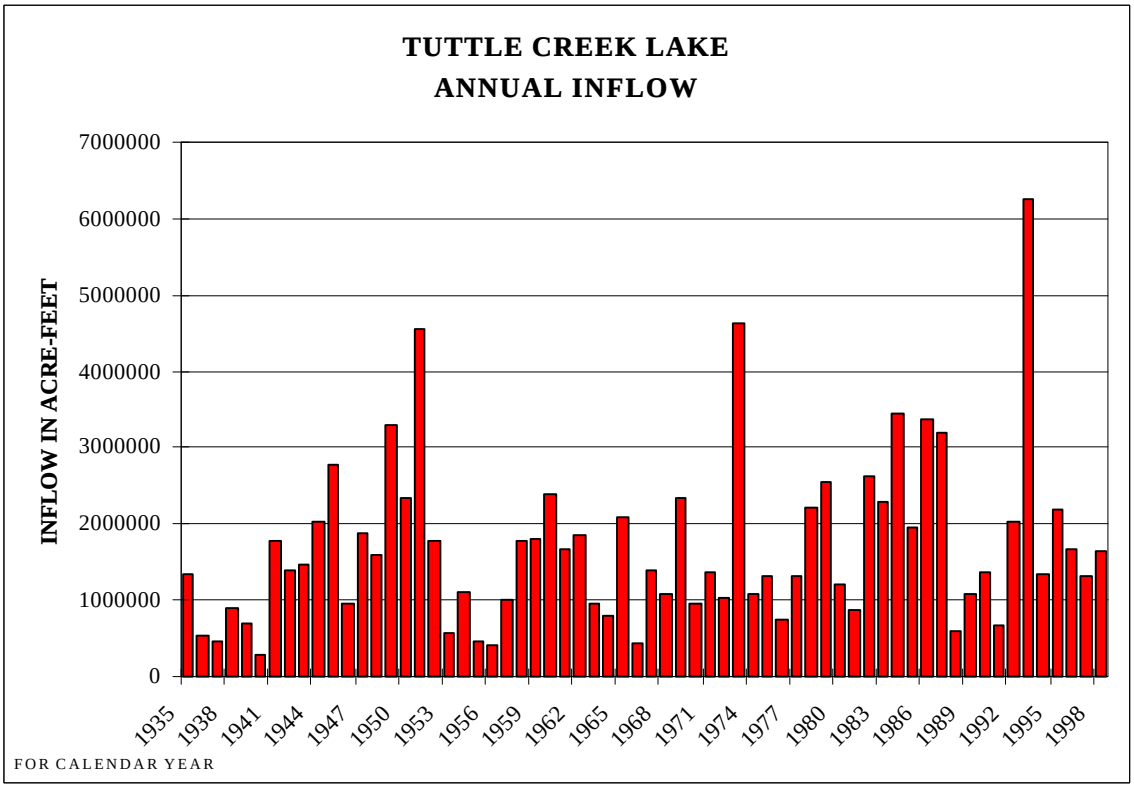


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1076.79 01 Aug 97	**1083.33 31 Jul 98**	**1086.41 02 Jul 98**	**1072.05 25 Feb 98**	**1137.7 23 Jul 93**	**1060.82 04 Jan 67**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
37,800 01 Apr 98	**2,027,491**	**14,000 03-08 Apr 98**	**60 06 Sep 97**

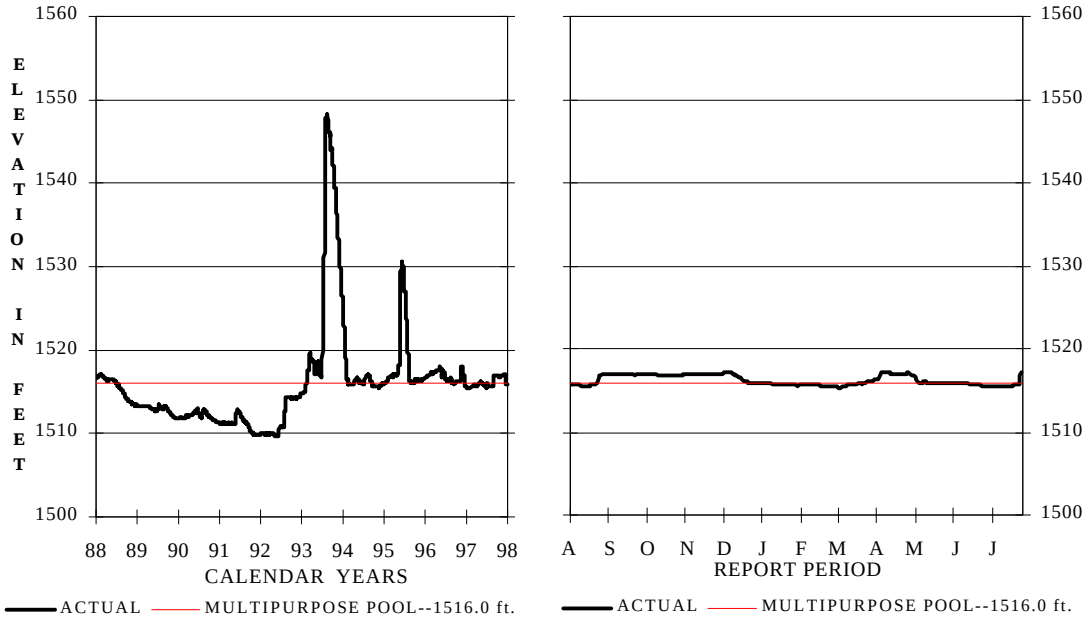
dsf = day-second-feet ac-ft = acre-feet


TUTTLE CREEK LAKE INFLOW
1997-98 ANNUAL REPORT
ACRE-FEET
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1935-97
HISTORICAL AVERAGE
ACTUAL


TUTTLE CREEK LAKE
ANNUAL INFLOW
INFLOW IN ACRE-FEET
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
FOR CALENDAR YEAR

WILSON LAKE
1997-98 REGULATION

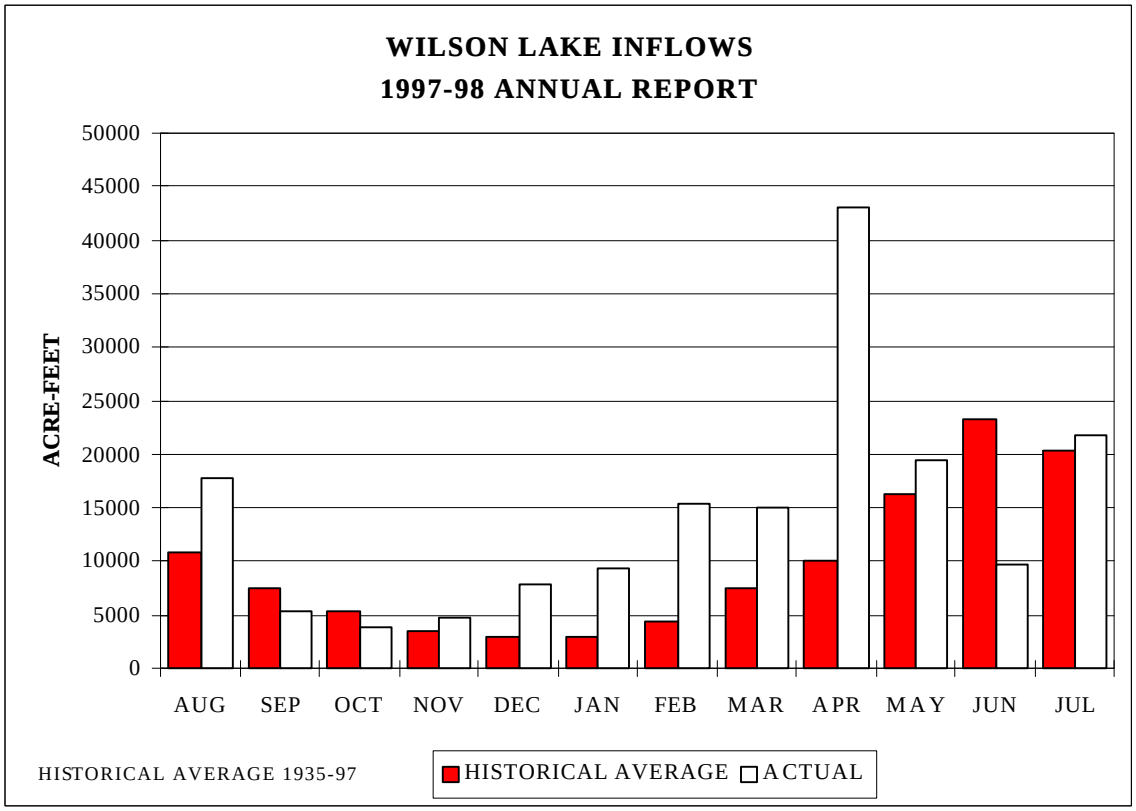
A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.

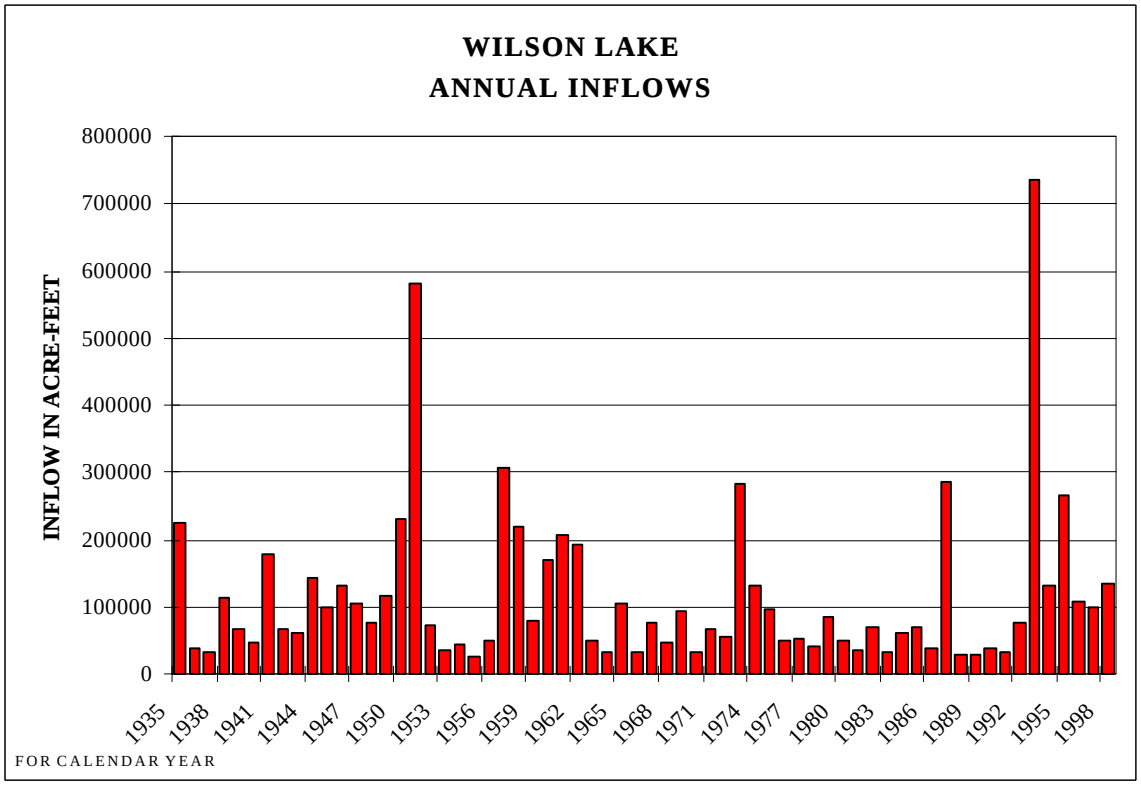


Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1515.65 01 Aug 97	**1517.24 31 Jul 98**	**1517.29 12 Apr 98**	**1515.35 05 Mar 98**	**1548.2 13 Aug 93**	**1493.59 23 Dec 66**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
4,450 30 Jul 98	**173,037**	**1,200 10 Apr 98**	**15 28 Feb 98**

dsf = day-second-feet ac-ft = acre-feet


WILSON LAKE INFLOWS
1997-98 ANNUAL REPORT
ACRE-FEET
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
HISTORICAL AVERAGE 1935-97
HISTORICAL AVERAGE
ACTUAL


WILSON LAKE
ANNUAL INFLOWS
INFLOW IN ACRE-FEET
800000
700000
600000
500000
400000
300000
200000
100000
0
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
FOR CALENDAR YEAR

APPENDIX B
BUREAU OF RECLAMATION PROJECTS

BONNY RESERVOIR

CEDAR BLUFF RESERVOIR

ENDERS RESERVOIR

HARRY STRUNK LAKE

HUGH BUTLER LAKE

KEITH SEBELIUS LAKE

KIRWIN RESERVOIR

LOVEWELL RESERVOIR

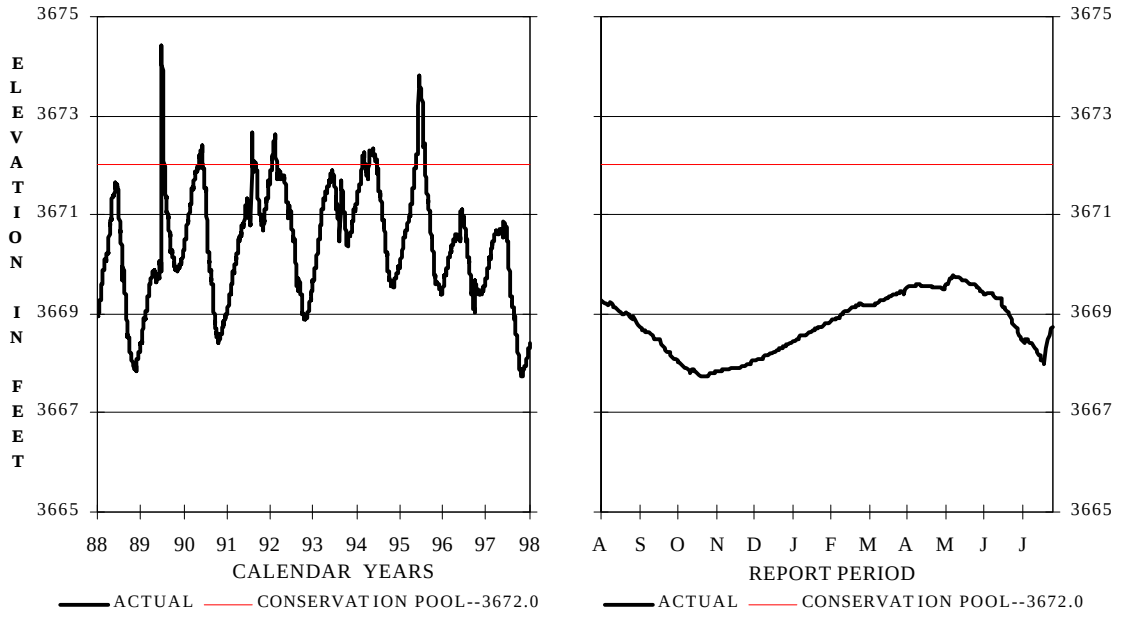
SWANSON LAKE

WACONDA LAKE

WEBSTER RESERVOIR

BONNY RESERVOIR
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



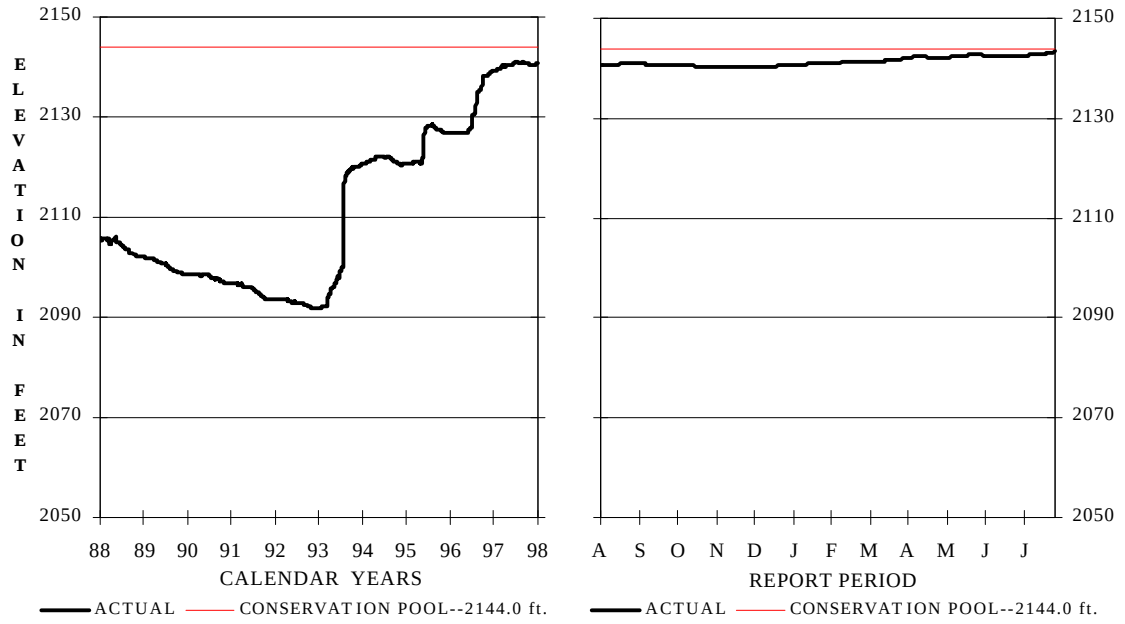
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
3669.28 01 Aug 97	**3668.73 31 Jul 98**	**3669.77 12 May 98**	**3667.72 22 Oct 97**	**3678.10 17 May 57**	**3661.20 6-14 Oct 52**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
340 26 Jul 98	**14,728**	**10 All Year**	**0 31 May 98**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

CEDAR BLUFF RESERVOIR
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



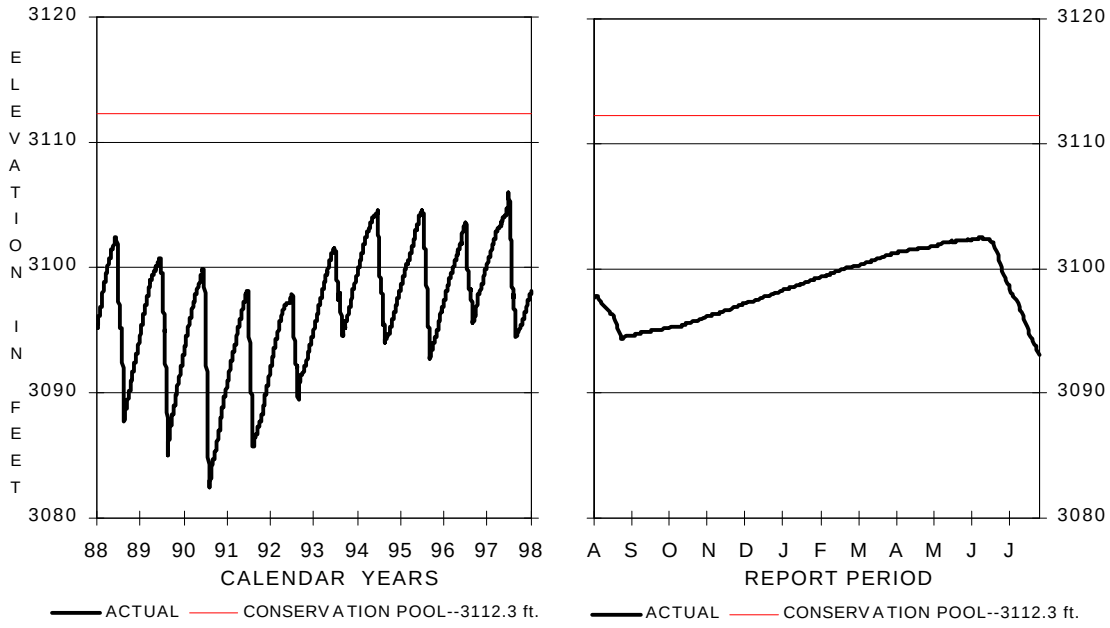
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2140.61 01 Aug 97	**2143.42 31 Jul 98**	**2143.42 31 Jul 98**	**2140.32 24 Oct 97**	**2154.90 4-5 Jul 57**	**2092.20 28 Sep 92**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
790 25 Jul 98	**46,790**	**100 15 Apr 98**	**0 All Year**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

ENDERS RESERVOIR
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



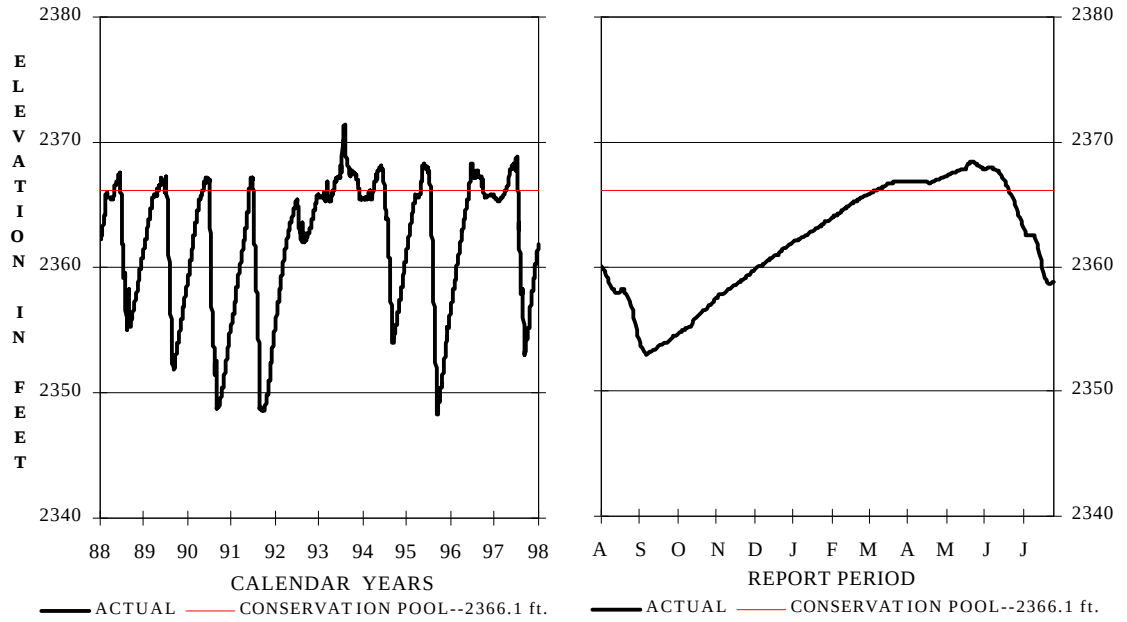
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
3097.83 **01 Aug 97**	**3093.09** **31 Jul 98**	**3102.45** **12 Jun 98**	**3093.09** **31 Jul 98**	**3118.20** **25 Apr 60**	**3080.67** **28 Aug 78**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
220 **11 May 98**	**15,710**	**210** **29 Jun 98**	**0** **Several Periods**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

HARRY STRUNK LAKE
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



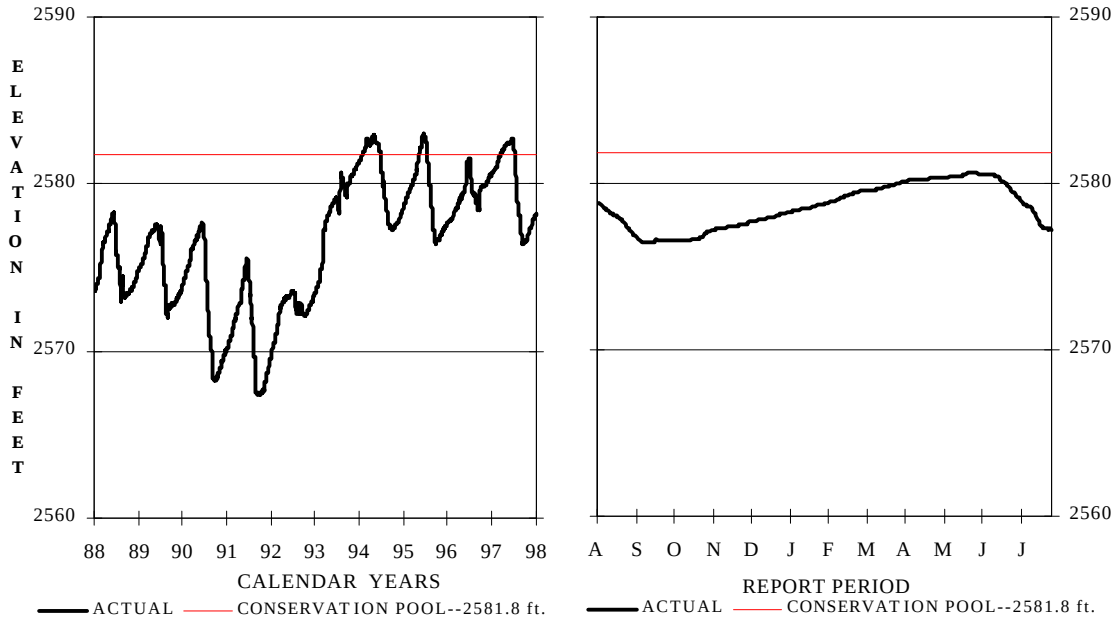
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2359.81 01 Aug 97	**2358.75 31 Jul 98**	**2368.34 26 May 98**	**2352.93 05 Sep 97**	**2374.10 23 Mar 60**	**2340.39 07 Sep 78**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
250 23 May 98	**38,747**	**360 21 Jul 98**	**0 Several Periods**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

HUGH BUTLER LAKE
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



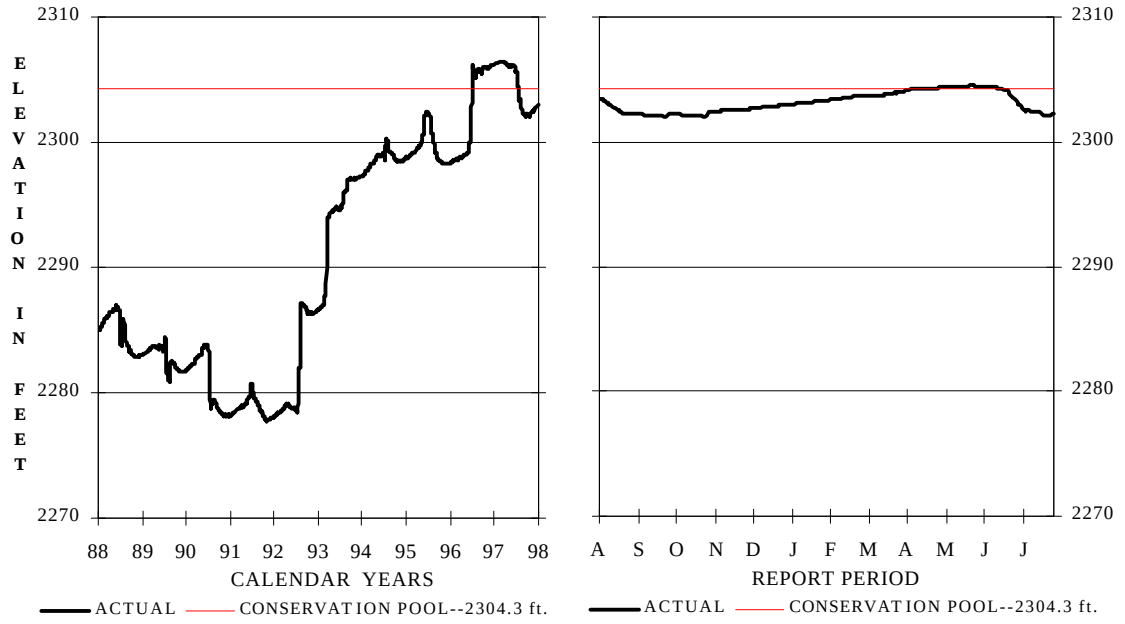
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2578.77 **01 Aug 97**	**2577.23** **31 Jul 98**	**2580.64** **28 May 98**	**2576.42** **05 Sep 97**	**2584.14** **15-16 Jul 67**	**2565.31** **08 Sep 78**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
130 **25 Oct 97**	**16,461**	**120** **22 Jul 98**	**0** **Several Periods**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

KEITH SEBELIUS LAKE
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



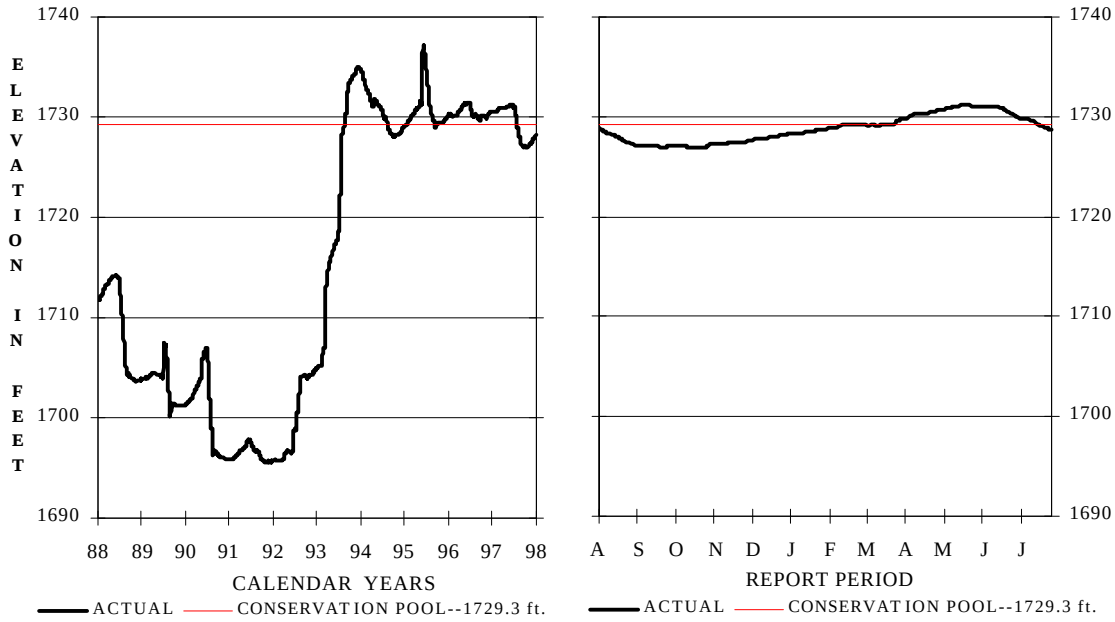
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2303.35 **01 Aug 97**	**2302.27** **31 Jul 98**	**2304.49** **25-28 May 98**	**2302.00** **21 Sep 97**	**2306.47** **15 Feb - 4 Mar 97**	**2275.82** **27-28 Jan 81**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
190 **10 Jul 98**	**13,655**	**120** **30 Jun 98**	**0** **Several Periods**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

KIRWIN RESERVOIR
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



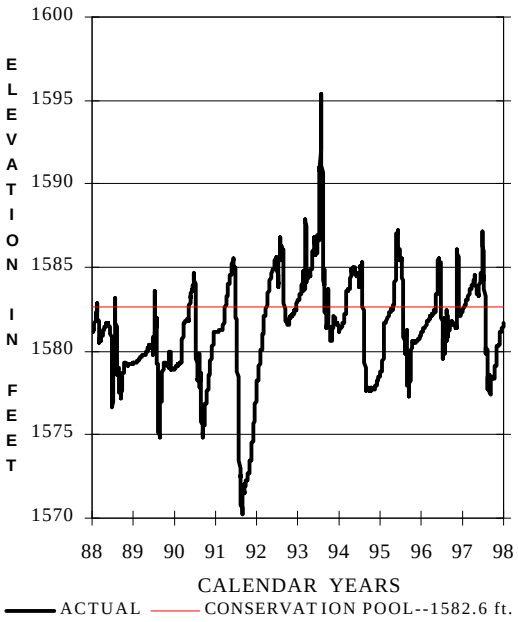
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1728.77 01 Aug 97	**1728.68 31 Jul 98**	**1731.21 20 May 98**	**1726.93 20 Oct 97**	**1737.07 02 Jun 95**	**1695.46 10-14 Feb 81**

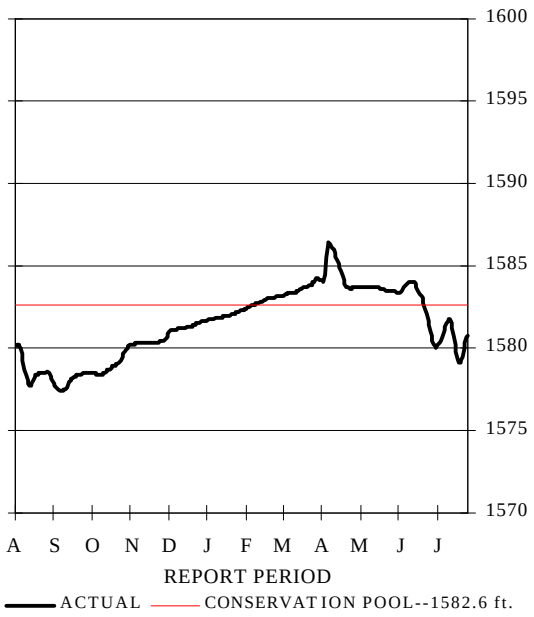
Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
440 28 Mar 98	**45,648**	**60 21-28 May 98**	**0 Several Periods**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

LOVEWELL RESERVOIR
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.





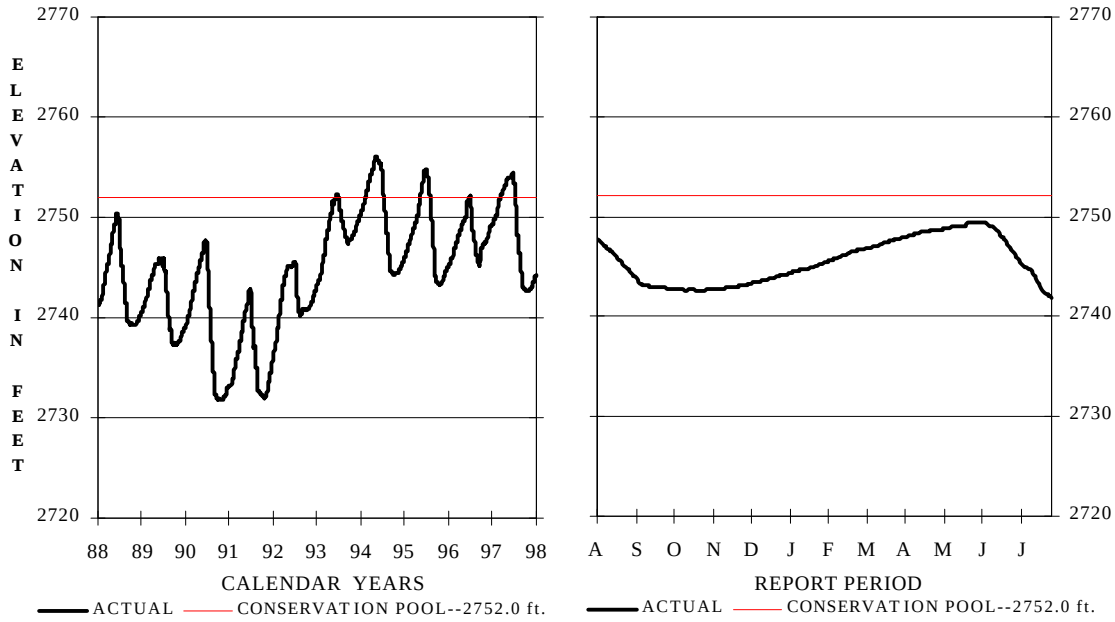
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1580.18 01 Aug 97	**1580.80 31 Jul 98**	**1586.37 10 Apr 98**	**1577.35 05 Sep 97**	**1595.34 22 Jul 93**	**1570.21 21 Aug 91**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
1,880 08 Apr 98	**80,586**	**500 11-21 Apr 98**	**0 Most Days**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

SWANSON LAKE
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



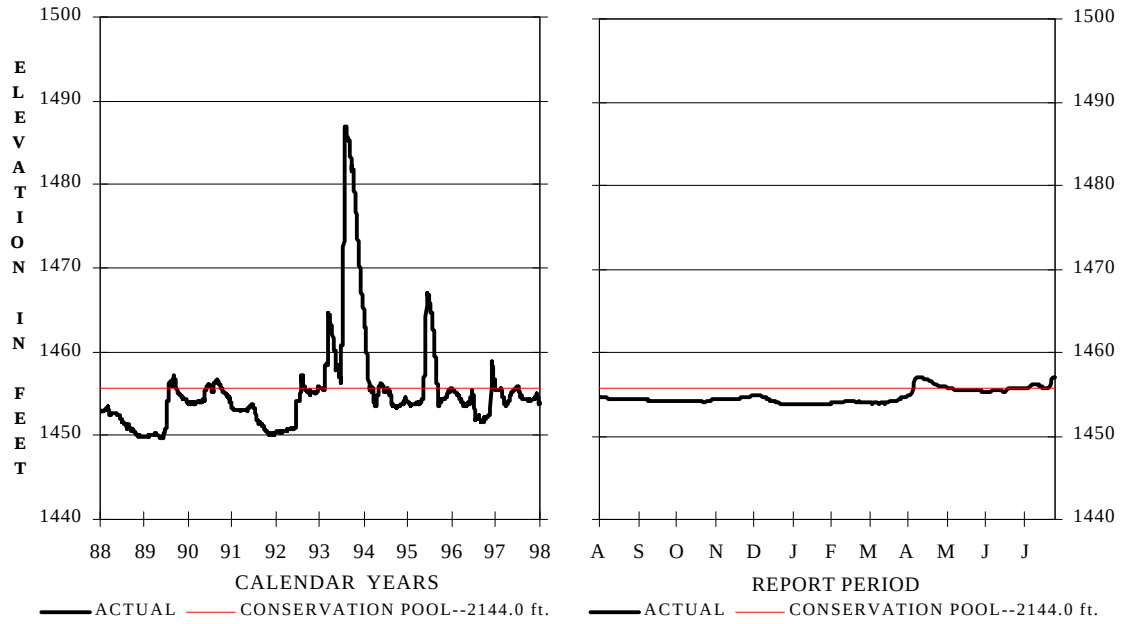
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
2747.59 01 Aug 97	**2741.88 31 Jul 98**	**2749.44 30-31 May 98**	**2741.88 31 Jul 98**	**2757.37 2-3 Jul 62**	**2722.61 24 Oct 54**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
1,060 28 Apr 98	**42,090**	**1000 28 Apr 98**	**0 Several Days**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

WACONDA LAKE
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



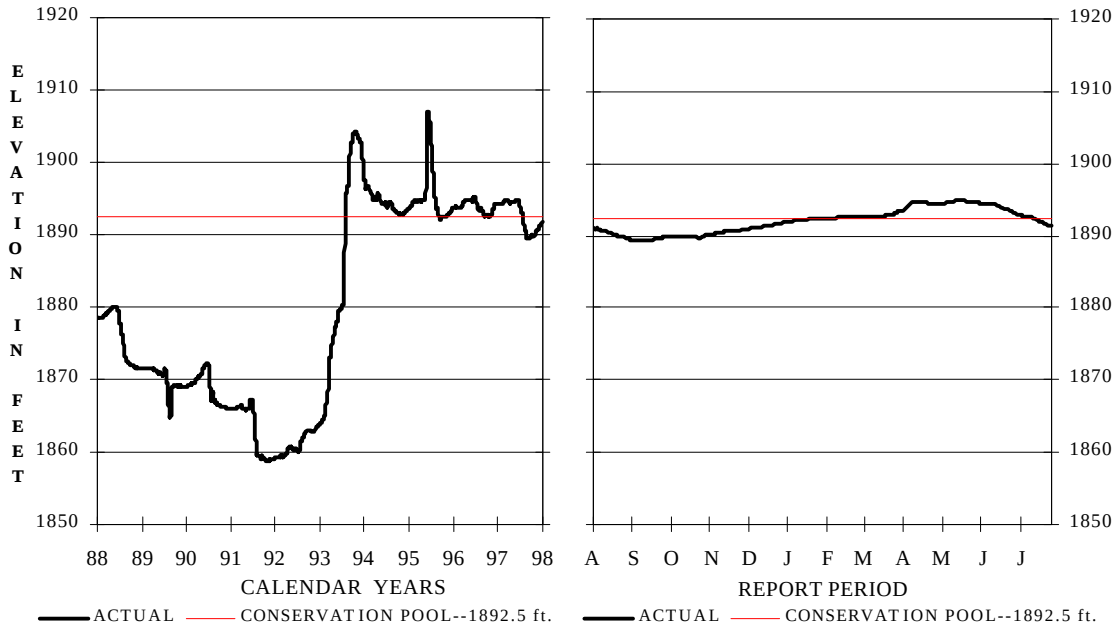
Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1454.55 01 Aug 97	**1457.01 31 Jul 98**	**1457.06 13 Apr 98**	**1453.69 14 Jan 98**	**1487.02 29 Jul 93**	**1448.90 5-7 Dec 84**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Minimum Release dsf.
4,760 08 Apr 98	**252,840**	**1,000 22 Jun 98**	**10 Several Days**

dsf = day-second-feet ac-ft = acre-feet Maximum outflow is the river release only

WEBSTER RESERVOIR
1997-98 REGULATION

A 10-YEAR POOL ELEVATION HYDROGRAPH IS SHOWN BELOW
WITH THE CURRENT REPORTING PERIOD EXPANDED FOR READING EASE.



Elevation, ft. msl.					
Starting Period	Ending Period	Period Maximum	Period Minimum	Historic Maximum	Historic Minimum
1891.02 01 Aug 97	**1891.39 31 Jul 98**	**1894.84 18 May 98**	**1889.39 12 Sep 97**	**1907.04 05 Jun 95**	**1857.33 23-24 Oct 71**

Report Period Inflow-Outflow			
Maximum Daily Inflow dsf.	Period Total Inflow ac-ft.	Maximum Daily Outflow dsf.	Low Flow dsf.
670 09 Apr 98	**51,577**	**200 22 Jun 98**	**0 Several Periods**

dsf = day-second-feet ac-ft = acre-feet Max outflow is the river release only